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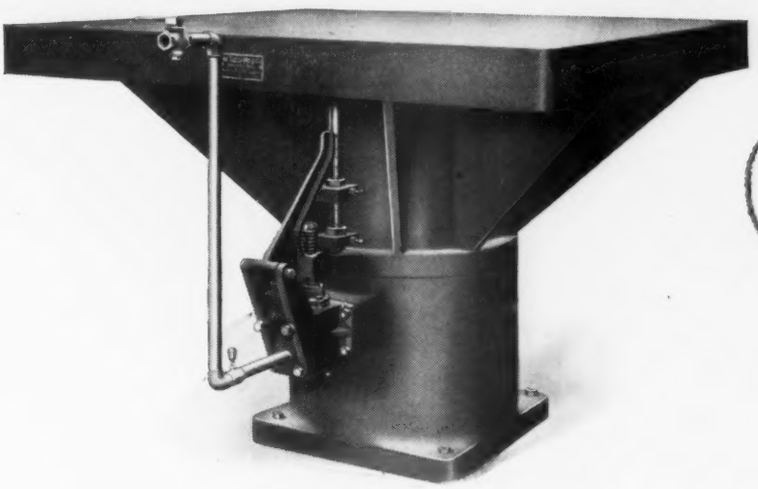

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THE FOUNDRY

Vol. 34, No. 6 CLEVELAND, OHIO, AUGUST, 1909 Whole No. 204

ORNAMENTAL BRASS REGISTER PARTS

Methods pursued by the National Cash Register Co. in the production of highly ornamented brass castings

THE brass foundry operated by the National Cash Register Co., Dayton, O., is a highly developed specialty shop devoted exclusively to the production of castings used in the manufacture of cash registers. The daily output averages from 18,000 to 21,000 pieces, weighing from 10 to 12 tons, and the consumption of copper approximates 11,000 pounds per day. With few exceptions, the castings are highly ornamented and of thin section, and while every facility has been provided to insure economical operations, the quality of the product, rather than the cost, is the factor of prime importance by which the practice is governed. In the completeness of its equipment, general arrangement and conveniences for employes, the foundry compares favorably with the other departments of this model plant. The foundry buildings are spacious, well-lighted, well-ventilated structures, and provide about 86,500 square feet of floor space, including a recently completed annex containing 32,000 square feet. The melting equipment is adequate and includes 132 crucible furnaces, one Porteous portable melting furnace for borings and scrap, two oil furnaces for special mixtures, and one Kroeschell-Schwartz crucible furnace. In addition, many register parts are made of a white metal mixture by the

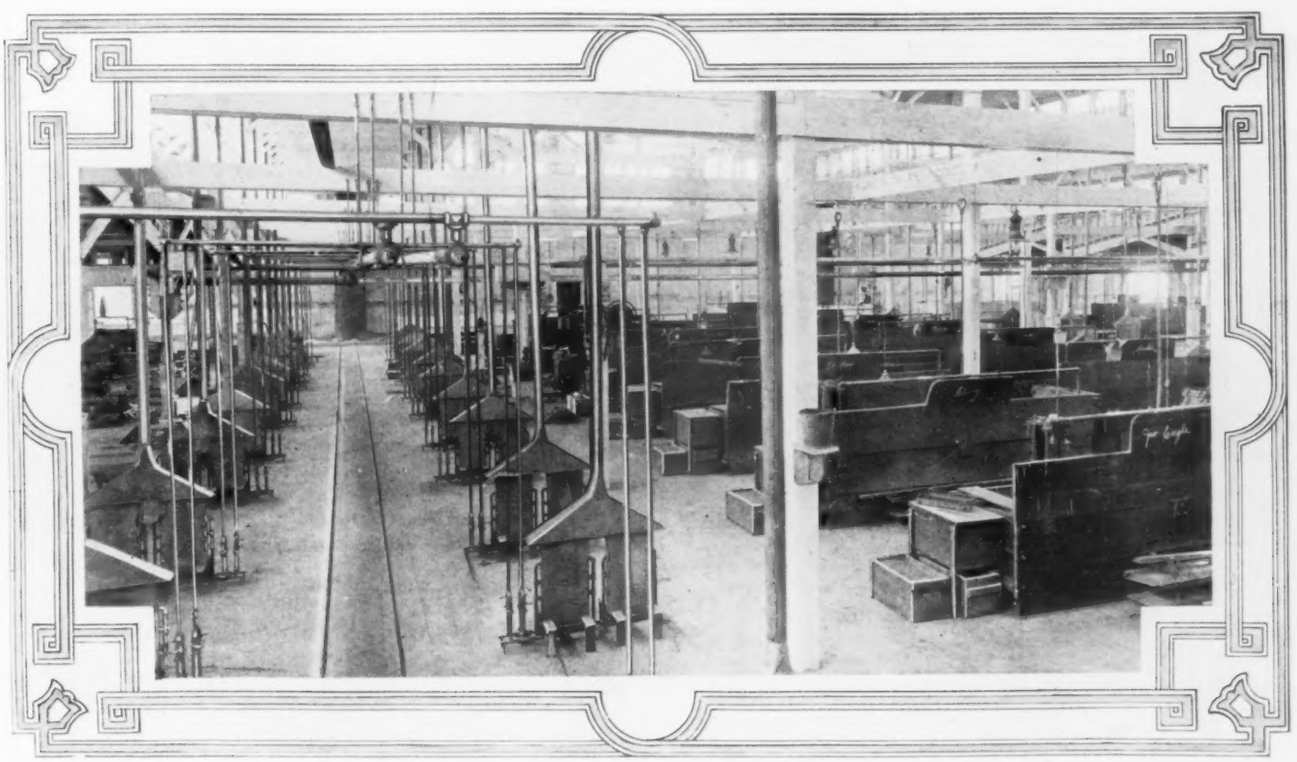


FIG. 1—GENERAL VIEW OF ONE OF THE NATIONAL CASH REGISTER CO.'S BRASS FOUNDRIES SHOWING TWO ROWS OF GAS HEATERS FOR SKIN DRYING MOLDS

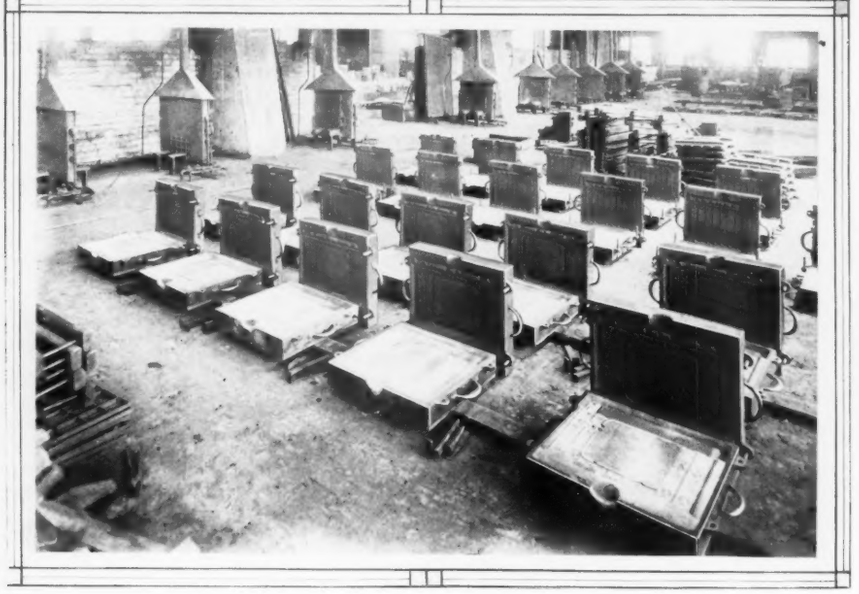


FIG. 2—LARGE MOLDS FOR CABINET PARTS CAST ON END

FIG. 3—MOLDS, SLIGHTLY TILTED, IN POURING POSITION

FIG. 4—LARGE MOLDS FOR CABINET CASTINGS BEFORE CLOSING

finished casting process, many of these sections being so intricate that it is impossible to satisfactorily mold them in sand. Including the cutting-off and cleaning room, there are 240 employes in the foundry department.

Molding Methods.

In this shop the molding machine has not made very great headway in supplanting hand-molding methods, although two Tabor and one Pridmore stripping plate molding machines are in use. Hand-molding operations are, however, facilitated in every way by the use of match plates and the mounting of patterns, whereby the daily output has been greatly increased. The treatment which molds for cabinet parts receive before closing in a way militates against the economies of the machine process. All of the molds for cabinet castings are skin dried by stoves burning natural gas. Two rows of these stoves are shown extending through the middle of the foundry, illustrated in Fig. 1. After the molds are made they are set on stools on either side of the stoves, and owing to the temperature maintained they are skin dried in a very short time. The molding methods vary with the classes of castings produced, and may be summed up as follows:—(1) regular green sand method, no facing being used; (2) regular green sand method, the molds being dusted with facing; (3) double ramming, the molds being rammed a second time after the facing has been dusted on; (4) double ramming, including the use of facing and skin drying the molds.

Returning the Mold to the Pattern.

The finish of the castings improves in the order in which the molding methods have been named. In place of returning the pattern to the mold, as is customary in stove shops where printing back is resorted to, the mold is returned to the pattern in this foundry, and not without reason. The molds are double-rammed and the practice is what the term implies. After the initial ramming, the mold is lifted off, faced, returned to the pattern, and again rammed. By this method all difficulties arising from damaged patterns are obviated, and the results are claimed to be better than when the patterns are returned to the molds.

Pneumatic Rappers.

In addition, all of the molding tubs have been provided with pneumatic rappers, exceedingly novel in construction. One of these rappers, attached to a molding tub, is shown in Fig. 6, and its construction and application to

a tub as well as the operating valve, are shown in Figs. 26 and 27. The piston does not move, but is bolted to the wooden strip on the tub and supports the rapper body and protecting pipe cover. The body of the vibrating rapper reciprocates slowly, due to its greater weight, and owing to its slow movement gives a heavier jar or vibration and uses less air than by reciprocating the lighter piston at an unnecessarily higher speed. The valve lever is at the floor line and is operated by the molder's foot. At the side of this valve lever in the air supply line is a two-way valve equipped with a Winkley oiler, providing a neat and convenient method of oiling.

The Vibrator Valve.

In the sectional view of the valve, Fig. 26, it will be seen that the air enters the center opening at one end of the stationary piston valve, follows the direction of the arrow until it strikes the body return shoulder, pushes it back until the air enters the groove of holes in the piston valve, and the body then travels in the opposite direction. The piston valve is of steel construction, while the rapper body is made of bronze. The sand protecting shield is a 2-inch iron pipe, capped on both ends, being damped with leather washers, but when in action the rapper body does not contact with these washers. These rappers make very little noise and are economical in the use of air.

Smoking Molds.

The smoking of molds with rosin has recently been done away with, and these are now being faced with a new compound especially prepared for this work. A considerable saving has been effected by this change, the finish of the castings improved, the liability of fire has been lessened, and the elimination of the rosin fires contributes materially to the physical well-being of the employes of the foundry.

Flask Equipment.

The flask equipment is well worthy of special mention. Special flasks have been designed for cash register sides, as shown in Figs. 2 and 5, while all of the cast iron, rectangular flasks in use are designed to conform to the sizes of the molds to be made therein. These flasks being interchangeable, enable the molder to make sufficient drags for one heat before he makes the copes, and being of special design, the use of sand is reduced to a minimum, as the wall of sand between the pattern and the flask is but a fraction of an inch. The flasks shown in Figs. 2 and 5 conform closely to the outlines

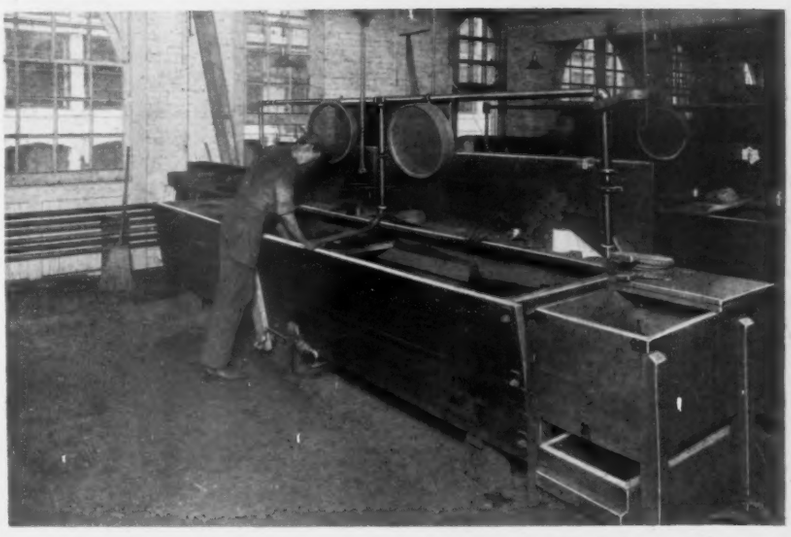
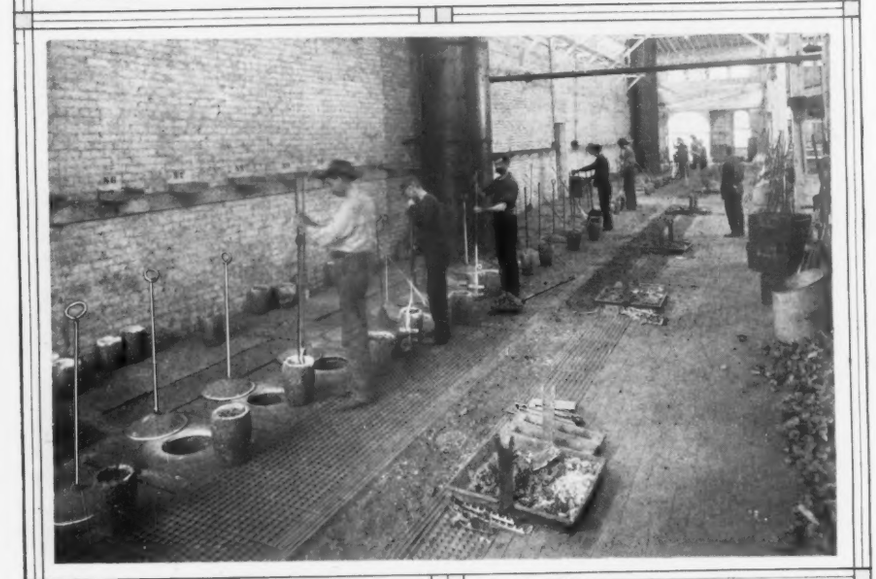


FIG. 5—MOLDS FOR CASH REGISTER ENDS BEFORE CLOSING

FIG. 6—PNEUMATIC RAPPER ATTACHED TO A MOLDING TUB

FIG. 7—THE MOLDING MACHINE FLOOR



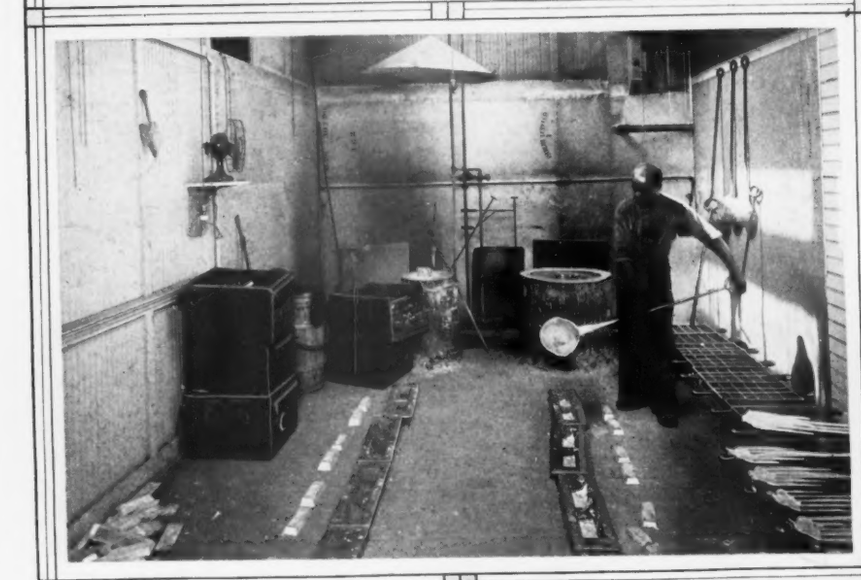


FIG. 8—PIT CRUCIBLE FURNACES ARRANGED IN CIRCULAR BATTERIES

FIG. 9—STRAIGHT LINE CRUCIBLE FURNACES

FIG. 10—WHITE METAL MELTING DEPARTMENT

of the patterns, while those illustrated in Fig. 4 are similarly constructed. The method of pouring very thin sections on end is also clearly shown in Fig. 2, while the method of clamping to prevent straining is also illustrated. All of the molds not poured on end are tilted, a practice almost universal in brass foundries. Several floors of tilted molds are shown in Figs. 3 and 7.

Match Plates.

A few of the many brass match plates in use are shown in Fig. 23; A is the drag side of a register top sign, two being made in a flask, and A^1 is the cope side of this plate; B is the cope side of a register base, 30 x 16 inches, and B^1 is the drag side of this plate; the check printer, hood plate C and C^1 has a depth of 2⅛ inches, the drag side being shown at C and the cope at C^1; D is the drag side of a register top sign match plate, two being made in a mold, and D^1 is the cope side; E is the drag side of another style of top sign plate, and F is the cope side of a match plate of another top; a match plate of a register side is shown at G and G^1, the first being the drag and the latter the cope. All of these plates are made of brass and their use greatly facilitates the molding operations.

Preparation of Facing Sand.

The preparation of the facing sand receives considerable attention and much of the success attained in the production of these art castings can be attributed to the treatment given this material. A grade of fine brass sand is used, which is dried in an exhaust steam drier especially built for this purpose. It is then put through a 40-mesh sieve and mixed with old sand in the proportion of one of old to five of new. This is then again riddled in a 16-mesh sieve, tempered and put through a flour mill as shown in Fig. 24, the rolls of which have a packing effect on the sand. For riddling the sand, pneumatic shakers are used, and as a result of this process the amount of new sand required has been greatly reduced and the finish of the castings improved.

Melting Equipment.

The metal for the molding floors is melted in 132 coke-fired, crucible furnaces and one Kroeschell-Schwartz crucible furnace using oil for fuel. Three circular batteries of pit furnaces are shown in Fig. 8, while a battery of straight line pit furnaces is illustrated in Fig. 9. The circular batteries were originally designed for the use of gas as fuel, but this has been

discarded and the furnaces have been arranged for the use of coke. It will be noted that no pot lifting devices other than the tongs have been provided, but owing to the comparatively small sizes of the crucibles used, they can be easily lifted from the furnaces by the melters.

Metal Room.

A view of the metal room is shown in Fig. 11. In this department an accurate record is kept of the metal used daily and all of the mixtures for the various heats are carefully made and weighed. It is the practice for the molder to inform the melter the kind of metal he requires for the castings he is producing, and the molder then makes only a sufficient number of molds that can be conveniently poured from one crucible. The amount of metal required is governed by the number of molds that can be made while the metal is being melted, and in this way a floor can be entirely poured off with each successive heat. When the melter has received his instructions from the molder, the clerk in charge of the metal room is notified that a certain metal is required for a certain furnace for that day, and the mixtures for the various heats are then made up. The metal room is partitioned off from the furnace department by shelves so constructed that they provide a series of square boxes, numbered both on the inside and outside, these numbers being the same as the numbers on the furnaces. Into these boxes the metal for each heat is placed by the clerk of the metal room, the melters thereby not being held responsible for the mixture. The side of these boxes opening into the metal room, is shown in Fig. 11, while the outside, facing the furnace department, is shown in Fig. 12.

This system greatly facilitates the melting operation, and in addition insures the economical use of the metal as well as the accuracy of the mixtures. For annealing the crucibles a steam heated room is provided, which is constantly maintained at a temperature of 300 degrees Fahr. The entire stock of pots is stored in this room and they are thoroughly annealed before being used.

White Metal Mixtures.

The oil-fired furnaces, Fig. 10, are used for making special white metal mixtures, which are cast into ingots and then transferred to the metal room. One furnace, in which the metal is melted in a crucible, is used for special copper mixtures, while the other, in which the metal is melted in

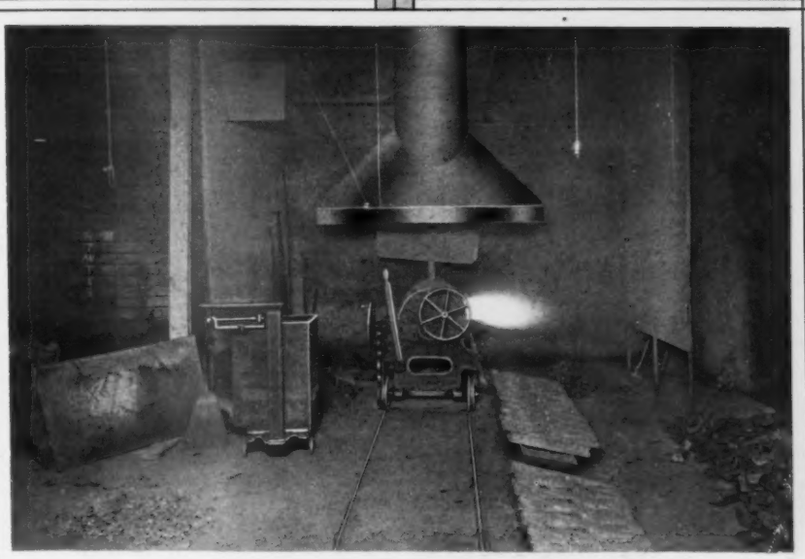


FIG. 11—THE METAL MIXING DEPARTMENT

FIG. 12—FURNACE ROOM SIDE OF METAL BOXES CONTAINING CHARGES FOR VARIOUS CRUCIBLES

FIG. 13—PORTEOUS FURNACE FOR MELTING TURNINGS, BORINGS, ETC., AS WELL AS THE METAL RECOVERED FROM THE FURNACE ASHES

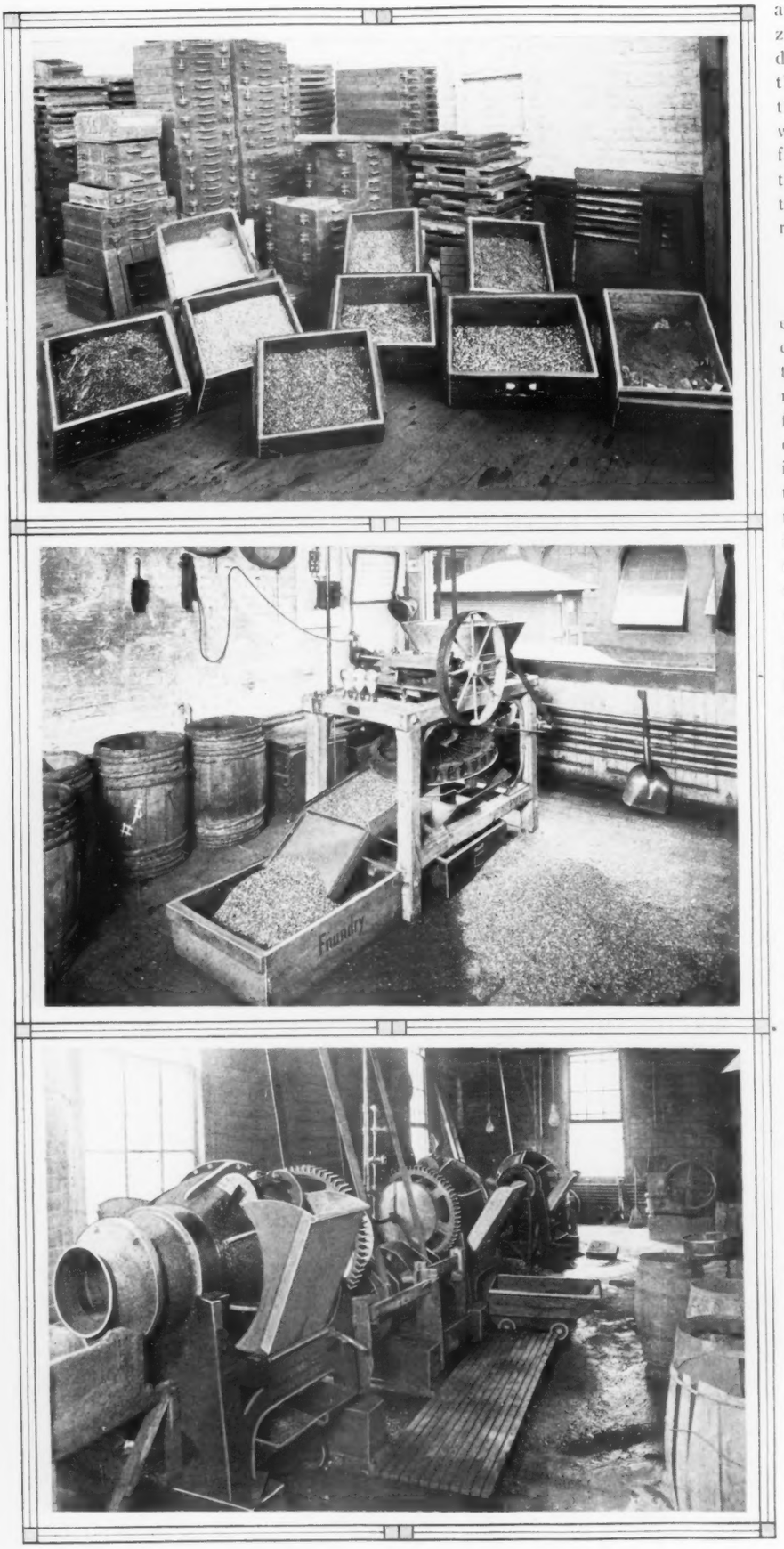


FIG. 14—BOXES OF TURNINGS, BORINGS, SWEEPINGS, ETC., BEFORE THEY HAVE BEEN CLEANED BY THE MAGNETIC SEPARATORS.

FIG. 15—THE DINGS MAGNETIC SEPARATOR.

FIG. 16—DEPARTMENT FOR RECOVERING METAL FROM THE FURNACE ASHES.

an iron pot, is used for tin, lead and zinc. Pig tin is also remelted in this department and cast into strips for the convenience of the employes in the metal room and to facilitate the weighing of mixtures. For the comfort of the melter in this department, three electric fans are provided, while the fumes from the furnaces are carried off by an exhaust fan.

Metal Recovery.

A thorough system of metal recovery greatly reduces melting losses, and every known device has been installed to maintain these losses at a minimum. The furnace ashes are first forked over for coke and large pieces of metal, and they are then crushed in a Sturtevant dry crusher and put through Hill water mills for the further recovery of the metal. As shown in Fig. 16, three Hill mills are in use. After the metal has been emptied from these mills, it is again washed in a 24-mesh sieve for the further removal of fine particles, and the metal recovered is dumped into barrels and conveyed to a Dings metallic separator, Fig. 15, where the iron, steel and other foreign particles are removed.

Remelting Recovered Metal.

All of the borings, drillings, sweepings, skimmings, etc., boxes of which, before being cleaned, are shown in Fig. 14, are likewise put through this separator to remove iron and steel which might otherwise injure the metal. After this material has been put through the separator, it is dumped into barrels, great care being exercised to keep the various metals separate, and these are then taken to the Porteous furnace room, Fig. 13, where the drillings, borings, skimmings, etc., are remelted and pigged. New copper in the proportion of 10 to 15 per cent is added and the size of the pigs is controlled by tilting the molds as shown. This furnace is operated by one man, and the metal thus recovered and remelted is subsequently transferred to the metal room in convenient form for handling in the furnace department.

Cleaning the Castings.

After the castings have been shaken out, they are piled on buggies as shown on Fig. 17, and transferred to the cutting-off and cleaning departments. The castings are first cleaned with wire brushes operated by flexible shafts, as illustrated in Fig. 18, and all of the dust and sand is carried off by an exhaust system underneath the cleaning benches. The work to

be cleaned is placed over a screen covering an opening in the bench, through which the sand is carried off. This system has been provided for the comfort of the cleaners and the room is absolutely free from dust at all times. For cutting-off the sprues and gates, four band saws are used, which are protected with wire guards. Inside gates are cut off by circular saws. Three grinding stands, equipped with exhaust hoods, are illustrated in Fig. 19. After the gates and sprues have been cut off, all adhering sand is removed in a dipping tank, Fig. 20. This likewise gives the castings a bright finish and further aids in detecting surface imperfections before shipment to the machine, polishing, buffing and plating departments. The dip consists of a solution of 50 per cent nitric and 50 per cent sulphuric acid. The castings are first immersed in water, then dipped into the acid, washed in hot water, and are finally dried in sawdust. Small castings are cleaned in a water mill.

Shipping Department.

The inspecting, sorting and shipping department is shown in Fig. 21. Here the castings are inspected for surface imperfections and are either passed or scrapped. After sorting, they are carefully placed in boxes for shipment to the machine department. For the large cabinet parts, special boxes are provided, constructed to prevent the castings from rubbing against each other while being conveyed from one department to another. An industrial railway system encircles this department on which the buggies carrying the boxes of castings operate. A view of one side of the buffing and polishing department, showing the stands provided with exhaust hoods, is shown in Fig. 22.

Die-Molded Castings.

Many register parts are now being successfully made of white metal by the finished casting process. A varied line of these castings is shown in Fig. 25, and many sections, intricate in design, that cannot possibly be molded in sand, are produced in this way. Furthermore, these castings require no further machining, and the only finishing operation necessary consists of the removal of the fins, which are only slight. This department is operated independently of the foundry, and the daily output averages thousands of pieces. The castings shown in Fig. 25 are the following cash register parts: Nos. 1 to 13, cylinder month wheel; Nos. 14 to 38, tape printer wheels; Nos. 39 and 40, cylin-

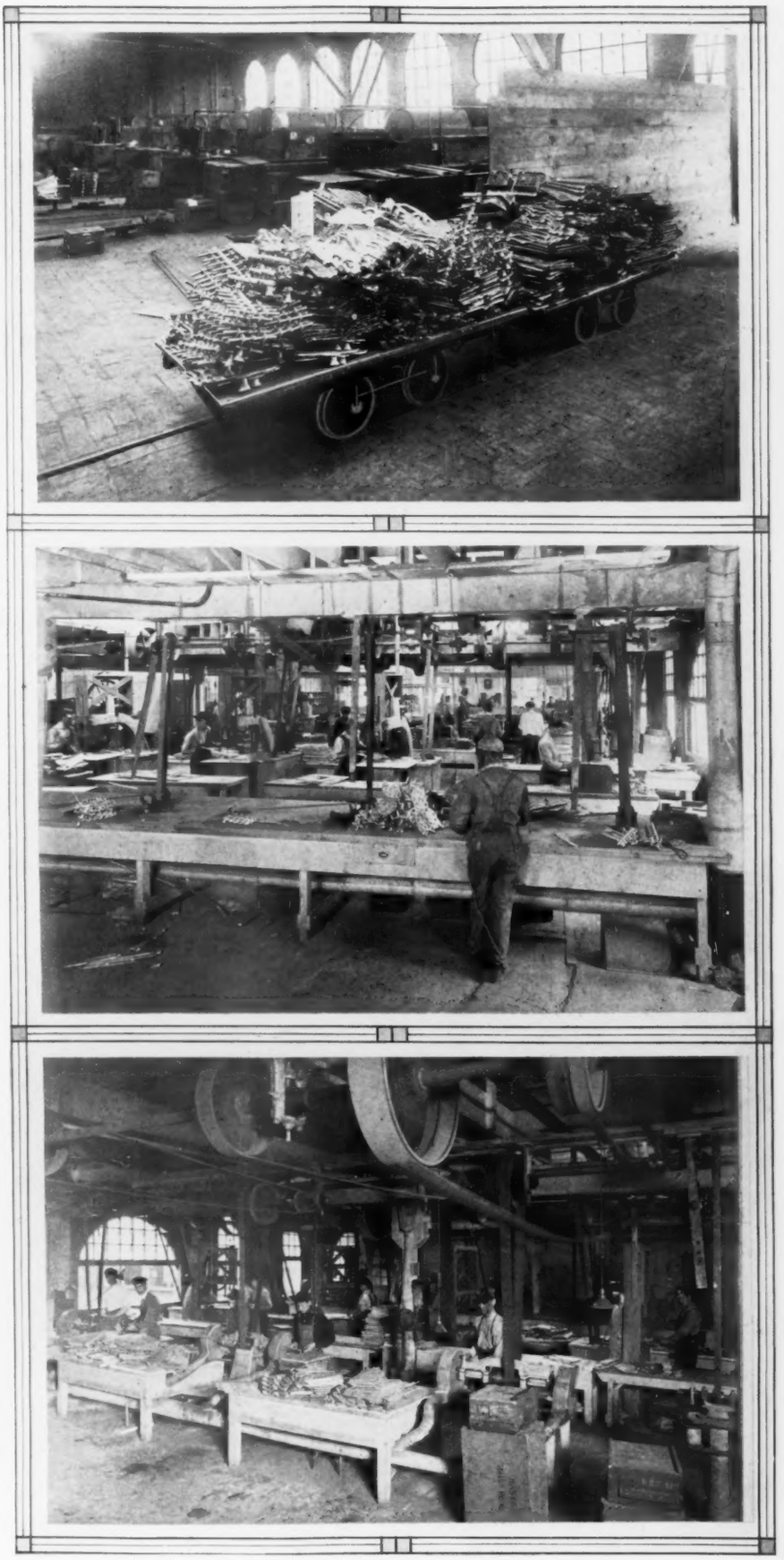


FIG. 17—FOUNDRY PRODUCT ON THE WAY TO THE CUTTING-OFF AND CLEANING DEPARTMENT

FIG. 18—CLEANING CASTINGS WITH FLEXIBLE SHAFT-DRIVEN WIRE BRUSHES

FIG. 19—GRINDERS EQUIPPED WITH EXHAUST HOODS

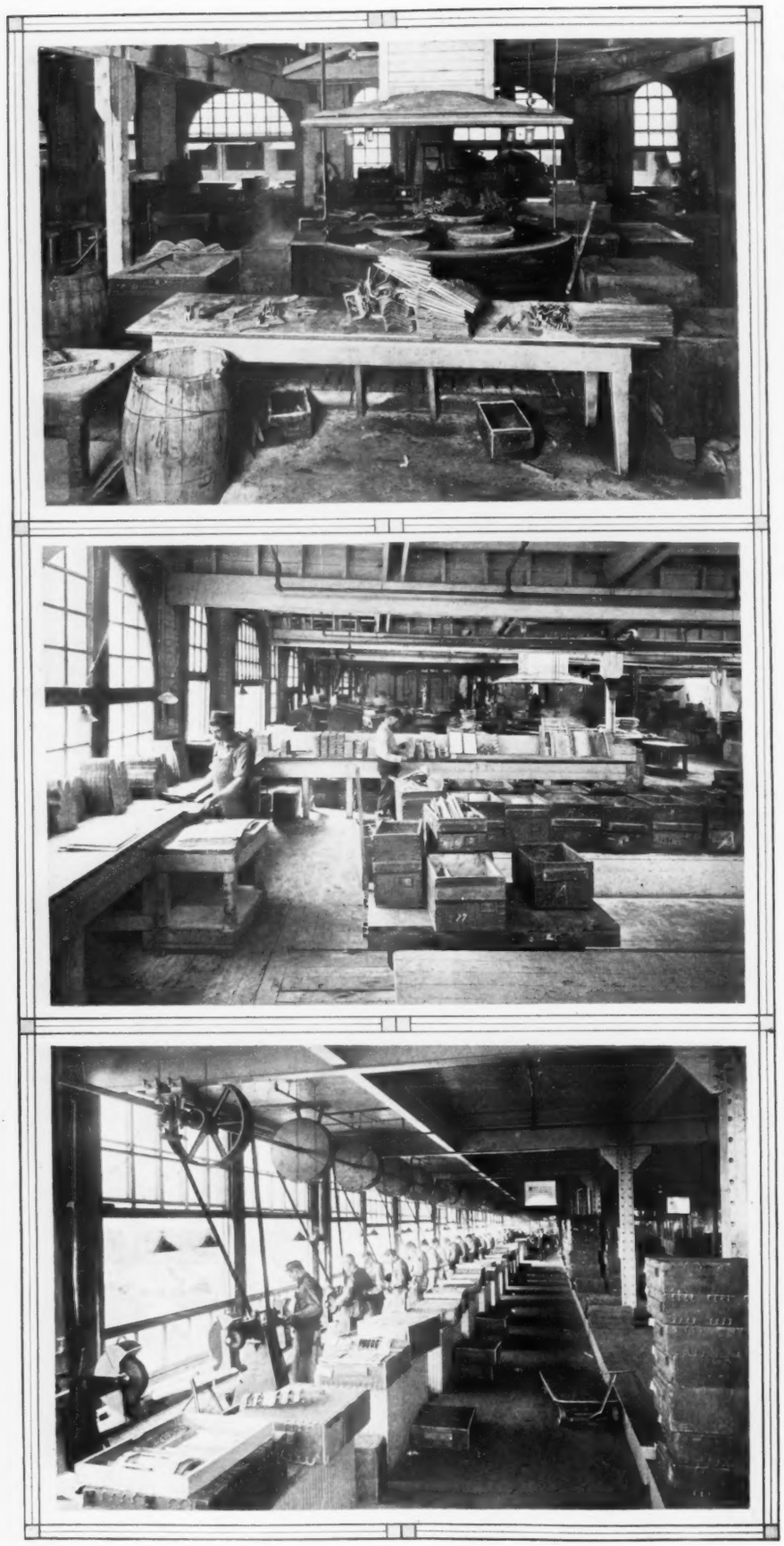


FIG. 20—DIPPING TANK PROVIDED WITH AN EXHAUST FAN

FIG. 21—INSPECTING, SORTING AND SHIPPING ROOM

FIG. 22—BUFFING AND POLISHING DEPARTMENT. THE STANDS ARE EQUIPPED WITH EXHAUST HOODS

der date wheels; Nos. 41 and 42, cylinder consecutive number wheels; No. 43, cylinder month wheel; No. 44, consecutive number wheel; Nos. 45 and 46, printer wheels; Nos. 47 and 48, auxiliary counter lock wheels; Nos. 49 and 50, detail wheels; Nos. 51 to 60, type wheels; No. 61, index indicator; No. 62, cylinder extension; Nos. 63 to 65, side lock centers; No. 66, draw lock center; No. 67, bell muffler lock center; No. 68, turn-to-zero lock center; No. 69, turn-to-zero lock frame; No. 70, side lock frame; Nos. 71 and 72, side lock frames; No. 73, bell muffler lock frame; Nos. 74 to 81, special counter frames; Nos. 82 and 83, counter frames; No. 84, side lock counter plate; No. 86, multiple drawer counter plate; No. 87, lid counter plate; Nos. 88 and 89, month and date wheel sets; Nos. 90 and 91, printer wheel sets; Nos. 92 and 93, month and date wheel sets; No. 95, pawl spring block.

Order System.

All orders for castings originate with the stock department, the original order shown in Fig. 28 being retained for future reference, while the order shown in Fig. 29 is sent to the foundry as its order and record of deliveries. When the order for castings has been completed, this card is sent to the stock department with the final delivery where it is receipted by the stockkeeper and returned to the foundry as its record of the fulfillment of the order. A card shown in Fig. 30 is also filled out and sent to the foundry as a pattern order, and after the pattern has been delivered it is retained by the molder until the required number of castings called for is made. The metal from which the castings are to be made is designated by symbols, in this case C being the symbol for good bronze. The total number of operations required on the cabinet part involved in this order is 15, and another card, Fig. 31, follows the order through the various departments until the castings called for are delivered to the stock department in their finished condition. It will be noted that on this card spaces are provided for the operation number and the department letter and the date when the work was commenced is also filled in. The order blanks for the various grades of metal are of different color, good bronze, symbol C, being pink; scrap bronze, symbol A, blue, etc.

Foundry Output Record.

The daily foundry statement of output is shown in Fig. 32. The total

product is listed under the symbols designating the various grades of metal and a space for a summary of the good product and back stock in the form of sprues, gates, etc., is also provided.

James McTaggart is supervisor of the metal cabinet department, which includes the pattern shop and pattern storage, the foundry, brass machine room, and the polishing and plating departments. John Logan is foreman of foundries.

CORES AND COREMAKING.*

By F. R. Cheney

In discussing the core question, whether in regard to the sand, the mixing, or the binders used, shop conditions and output are naturally important factors. As all pig irons may be called good irons when properly mixed and used in the right place, so all core binders are good for their respective lines of work, when treated with the proper degree of intelligence.

Core binders may be divided into two general classes: First, the oils or binders not easily affected by moisture, such as linseed oil, oils with a linseed base, dry black compounds, rosin, etc. Second, starches or binders readily affected by moisture, such as flour, glue, molasses and combinations of similar materials.

The Core Binder Salesman.

The deepest research so far made into the history of the core room, fails to show a single instance where the core binder salesman and demonstrator did not make a good core at a very attractive ratio of binder to sand, no matter what binder or compound he had, nor what kind of sand he used, whether it was bank, pit, lake, river or mountain. He made a smooth, firm, strong core at anywhere from one part of binder to 15 to 90 parts of sand—and why? Simply because he was a good mixer. If he were in a well managed core room and had to show a high mixing ratio, perhaps those watching him wondered if he would not wear the sand out by rubbing it before making it into a core. But no—he knew that he only had one part of compound that must come in direct contact with 80 parts of sand to make a satisfactory core, and the way to get it there was to rub and mix it thoroughly. He did not merely shake it through the riddle and let the outer edge of a conical shaped pile

*Presented at the Cincinnati convention of American Foundrymen's Association.

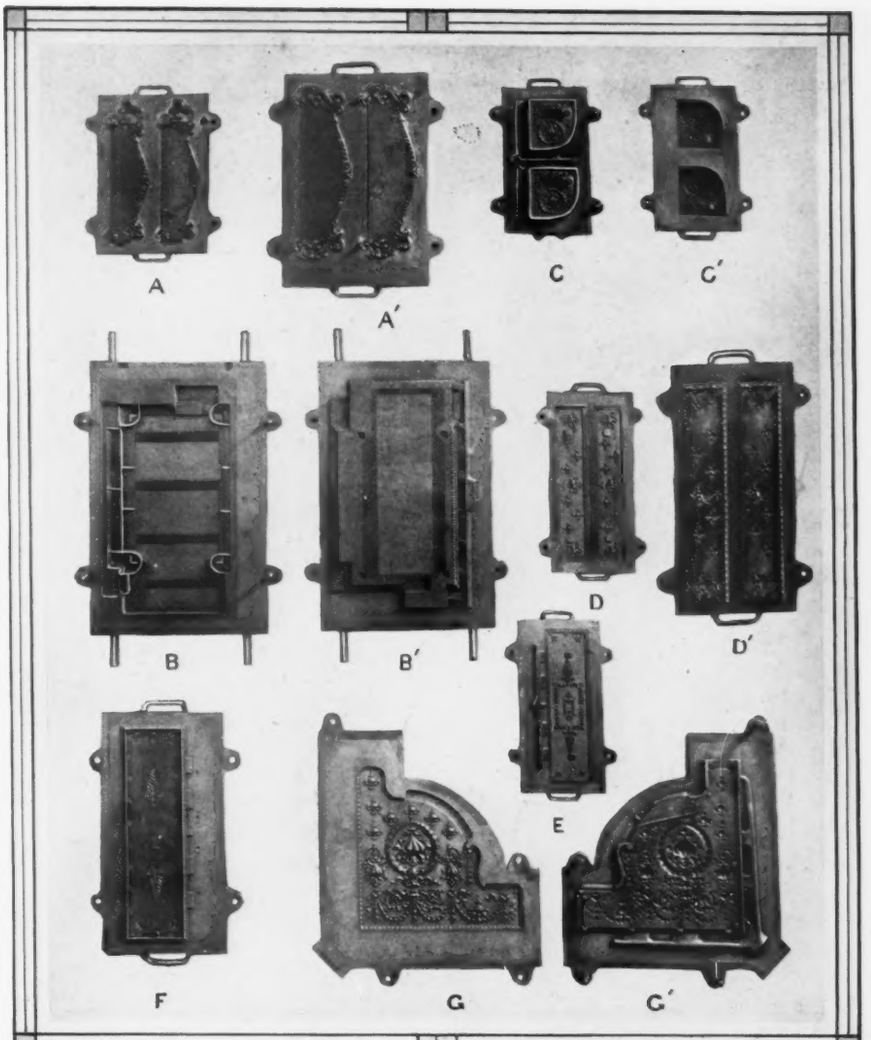


Fig. 23—Assortment of Brass Match Plates Used for Molding Ornamental Cash Register Castings

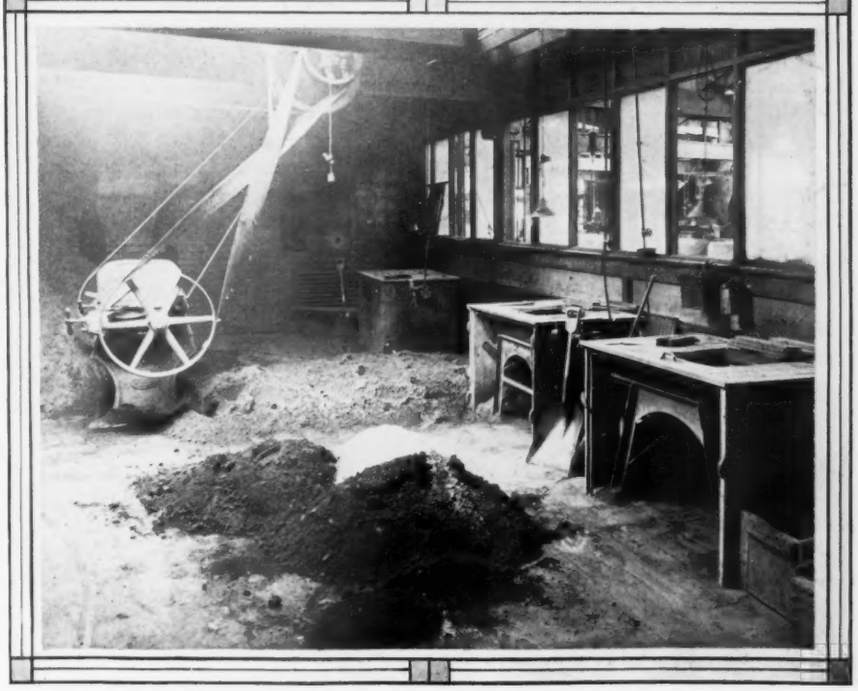


Fig. 24—Room in which the Facing Sand is Prepared

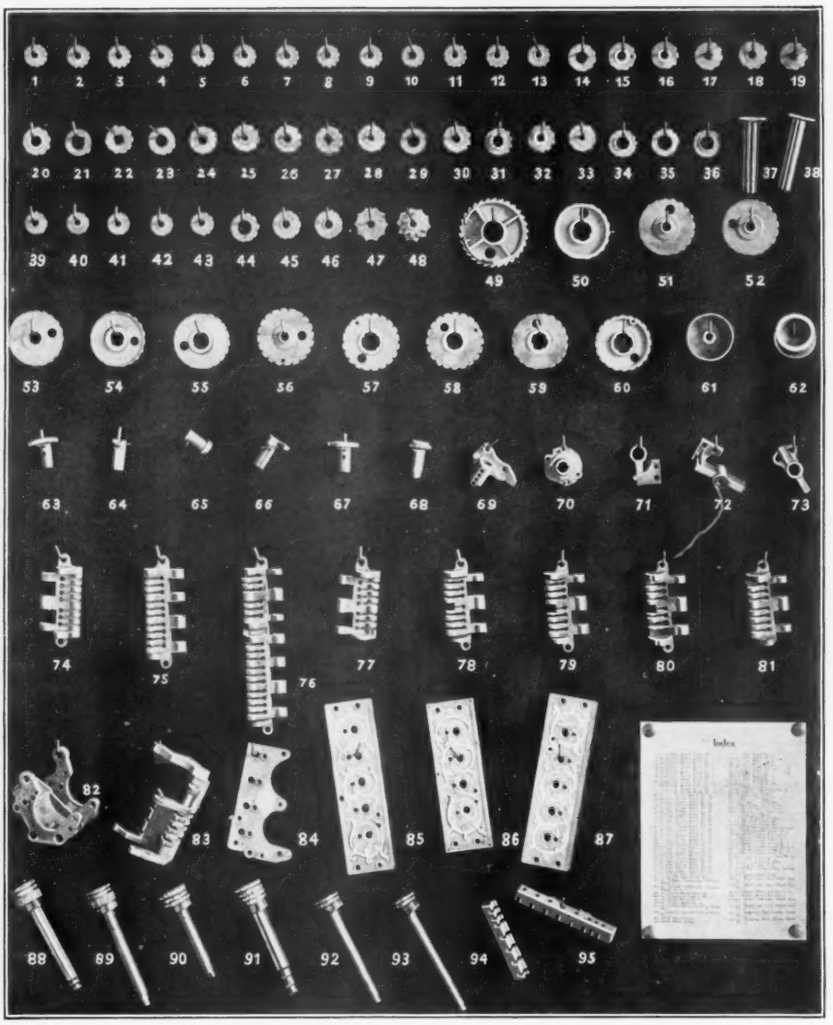


FIG. 25—DIE-MOLDED, WHITE METAL CASH REGISTER CASTINGS

have ten parts of binder to one of sand, caused by the globules of binder rolling down the outside, leaving in the middle of the pile about one of the binder to 150 parts of sand. He mixed his materials together thoroughly by rubbing, thus making a good core when properly baked.

Cores Affected by Moisture.

In foundries that are taking off a heat every day it is not quite as necessary to be so particular as to whether the binder is liable to be affected by moisture or not, for the reason that the core does not often remain in contact with the green sand long enough to become soft from the absorption of moisture in the molds; but where the time of the heats is uncertain and green sand work done, it is much safer to use a binder that is as little affected by dampness as possible.

A core made with a binder that is sensitive to moisture may come from the oven in perfect condition and yet if it remains in a green sand mold for 24 hours it will be the cause of blow holes in the casting on account of the moisture absorbed. It is possible for cores made with flour, glue, molasses, or similar material, when left on shelves in a partially open room during wet weather, to look all right and yet to have absorbed enough moisture from the air to ruin every casting in which they might be used.

Cores made from linseed oil or a high grade of core oil, having linseed oil as a base, or the dry black compounds having coal-tars as the base, can be handled without very much regard to weather conditions. They may be kept for weeks in an open shed, where the rain and snow can pass over them, without injury to the cores and without danger of imperfect casting, if they are dried before being placed in the mold.

The proportion of binder to sand depends on the thoroughness with which the two are mixed together, as well as on the quality of binder, grade of sand or size of core.

Mechanical Mixer.

If the quantity of cores used will warrant the installation of a mechanical mixer, material as well as time can be saved. As previously mentioned, the successful demonstrator rubs the binder and sand together. This can be done mechanically with a sand or mud mill, and about 25 per cent binder saved over the hand method of mixing. This is due to the heavy iron roll that travels in the pan and kneads and mixes the mass thoroughly in a very few minutes.

The mud mill will also grind up the old cores. In using over the completely burned cores, it is difficult to properly temper the burned sand on account of its apparent imperviousness to water if the operation is undertaken by hand. With the mud mill, burnt sand, gang-way sweepings, or other fine refuse, and a binder in the ratio of one part of compound to 20 to 80 parts of old sand, depending on how completely the old cores were burnt out, without new sand or

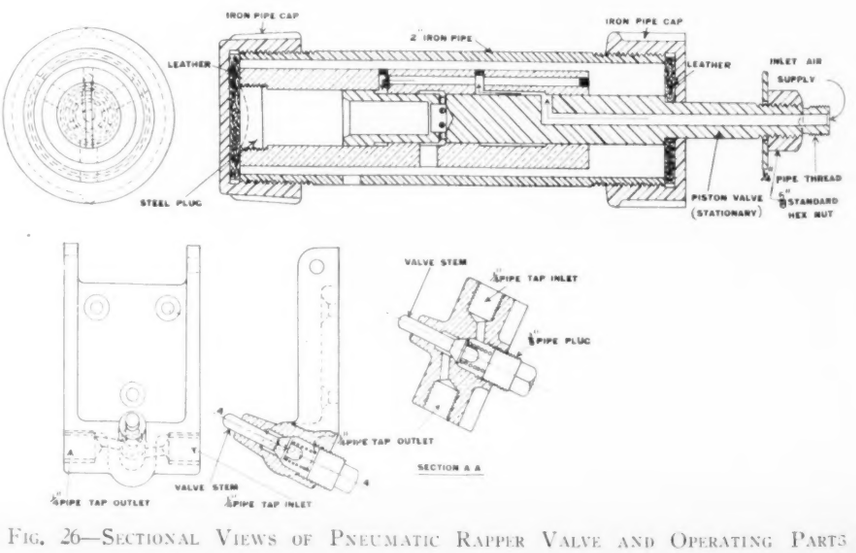


FIG. 26—SECTIONAL VIEWS OF PNEUMATIC RAPPER VALVE AND OPERATING PARTS

clay wash can be used. Cores, 5 feet long by 3 feet wide and from 1 to 6 inches thick are being made successfully every day from nothing but old sand in the ratio of 1 part binder to 30 parts old core sand and gangway mash. To accomplish this, the dry sand is first put into the mill, then 1 part of binder to 30 parts of the sand. The mill is allowed to revolve a few times to mix the sand and binder, then the water is turned in until the mixture is thinner than is generally used, in fact the stock is almost mushy.

Making Cores.

In making cores, see that the core box is clean to insure a smooth draw. For general work, throw the sand into the box by hand with sufficient power to force it into all the corners and angles. Then continue putting in sand until enough is there to support the core rods without danger of the rods cutting through the sand when they are firmly pressed down. The more crooked and the rougher the rods, the better they will tie and hold the stock together. After the rods are placed, fill and heap up the box with sand, then ram with a large flat rammer hard enough to compress the entire stock into one firm mass, but do not make such a hard core that the iron will not lay quietly to it.

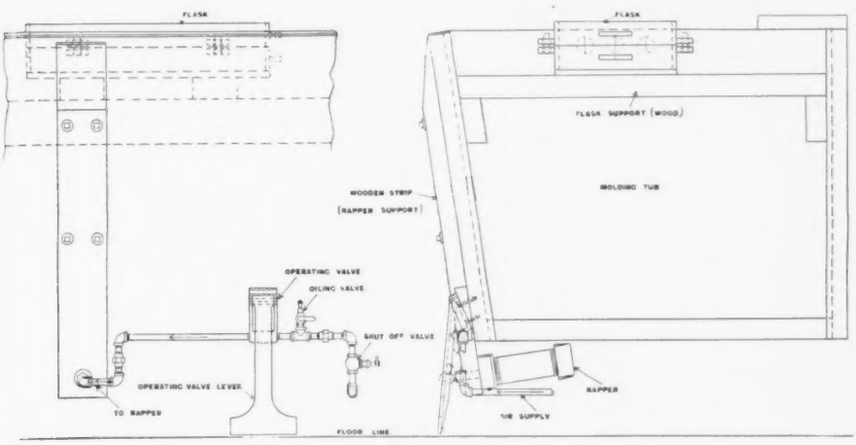


FIG. 27—FRONT AND SIDE ELEVATION OF PNEUMATIC RAPPER ATTACHED TO MOLDING TUB

THIS FORM MADE OUT BY STOCK DEPARTMENT

Part and Order No.	METAL	Maturity
6911201	GOOD BRONZE	
PART NAME: 500 Lower front 1		Metal Symbol: C
Quantity Ordered: 25	Number Per Box: —	Pattern Number: 647-L
First Operation: 19s	Total No. of Operations: 15	Bin Number: 732704
TO FOUNDRY		6-9 DATE
PLEASE GET OUT ORDER AS ABOVE STOCK DEPARTMENT, Per		HAL
REMARKS: Sample		

IS RETAINED BY STOCK DEPARTMENT

The Foundry

FIG. 28—FOUNDRY PRODUCTION ORDER RETAINED BY THE STOCK DEPARTMENT

THIS FORM MADE OUT BY STOCK DEPARTMENT

Part and Order No.	METAL	Maturity
6911201	GOOD BRONZE	
PART NAME: 500 Lower front 1		Metal Symbol: C
Quantity Ordered: 25	Number Per Box: —	Pattern Number: 647-L
First Operation: 19s	Total No. of Operations: 15	Bin Number: 732704
TO FOUNDRY		6-9 DATE
PLEASE GET OUT ORDER AS ABOVE STOCK DEPARTMENT, Per		HAL

Sample

DELIVERIES

Date	Quantity	Total Cast to Date	No. of Boxes Shipped	Date	Quantity	Total Cast to Date	No. of Boxes Shipped

GOES TO FOUNDRY AS THEIR ORDER AND RECORD OF DELIVERIES

The Foundry

FIG. 29—COPY OF ORDER SENT TO AND RETAINED BY THE FOUNDRY

THIS FORM MADE OUT BY STOCK DEPARTMENT

Part and Order No.	METAL	Maturity
6911201	GOOD BRONZE	
PART NAME: 500 Lower front 1		Metal Symbol: C
Quantity Ordered: 25	Number Per Box: —	Pattern Number: 647-L
First Operation: 19s	Total No. of Operations: 15	Bin Number: 732704
TO FOUNDRY		6-9 DATE
PLEASE GET OUT ORDER AS ABOVE STOCK DEPARTMENT, Per		HAL
PATTERN DEPT. WILL PLEASE DELIVER PATTERNS CALLED FOR ON ABOVE ORDER FOUNDRY, Per		

Sample

THE N. C. R. FOUNDRY STOCK PRODUCTION ORDER

TO FOUNDRY AS PATTERN ORDER AND MOLDER'S CARD

The Foundry

FIG. 30—PATTERN ORDER AND MOLDER'S CARD

Precautions.

As a precaution against cores coming apart, avoid as far as possible building them up in layers, either by ramming evenly every 2 or 3 inches, or placing layers of straight core rods crossed, and putting in vent material in the shape of coke, sawdust, etc., in layers that are too even.

A core can be properly baked with either a slow or a hot fire, but can not turn out well when the flame comes in contact with the surface of the core, for in that case the binder is disintegrated.

Do not neglect your core room or think the making of cores a secondary consideration. Quite often the most intricate part of the mold depends on a core, which also, quite often, is given

ORDER FOR 500 STOCK

PART AND ORDER NO.	BOX NUMBER	DUE IN STOCK	TOTAL NO. OPER.
6911201			15

NAME OF PART: Lower fronts 1

647–L — WEIGHT OF BOX: LBS. / OZ.

QUANTITY ORDERED	NUMBER PER BOX	DATE ORDERED
25		Jun–9 1900

OPERATION NUMBER AND DEPARTMENT LETTER	QUANTITY OF PARTS DELIVERED	DATE BEGAN WORK MO.	DATE BEGAN WORK DAY	WORKMAN'S CHECK NO.	X N I	GAUGED BY	QUANTITY SENT AHEAD	LOSS OR GAIN
1 19s								
17								
18				Sample				
19								

Pcs. Sent to Stock

Rec'd by

190

Bin No. 732704

(Reserve for R. of W. Sticker)

The Foundry

FIG. 31—THIS CARD IS SENT WITH THE ORDER TO THE VARIOUS DEPARTMENTS UNTIL THE STOCK IS FINISHED

to some boy to make, instead of to a coremaker of experience. If a foundry is short of experienced molders, the judicious use of cores as slabs tied to the cope for deep lifts will permit an apprentice to do work that otherwise might be delayed.

Bear in mind that no matter how well your iron is purchased and mixed by expert metallurgists; no matter how hot it comes from the cupola by the best of melting practice; and no matter how perfect and clean a mold you have made, if you put into that mold a poor core, your casting will be scrap and your expert labor instead of yielding revenue will be a complete loss.

SMALL CHARGES FOR THE CUPOLA.

BY RICHARD MOLDENKE

Question:—I would like to know whether the change in cupola practice suggested by Richard Moldenke applies to heavy work and could be used satisfactorily on large heats, approximating 25 tons. The cupola in our foundry has an inside diameter of 54 inches and is equipped with two sets of tuyeres, the lower tuyeres being 18 inches above the sand bottom.

Answer: — The method suggested, wherever tried, has given most excellent results for all charges. Great care should be exercised in preparing the bed and charges as low as 1,000 pounds for a cupola of this size, with a proportionate amount of coke between, will prove adequate. At the Cincinnati convention no less than 30 foundrymen expressed themselves well pleased with the idea, and where there was any doubt, investigation proved that the bed was originally too low, and hence the melting was hurt from the start. If those who are interested will address me at Watchung, N. J., I will gladly send them a copy of the pamphlet in question. My own experiences have shown the very worst evil, not excepting even high sulphur, to be the burning of the metal in melting.

REPAIRING PATTERNS.

BY H. N. TUTTLE

Question:—Is there any composition that can be successfully used for repairing the parting lines of worn patterns for machine use?

Answer:—For a somewhat similar purpose I have used a cement made of wax and rosin, thickened with sifted whiting. In some cases burnt shellac is satisfactory. A handful of flake shellac may be placed in a cloth dipped in boiling water and then pressed to an egg-shaped mass. This is then melted over an alcohol lamp and the drippings pressed into place by waxing irons. A soldering copper may be used if desired.

The following recipes have been recommended to me for patching and building up patterns: eight parts of pulverized litharge, 16 parts of dry white lead, two parts of sawdust and two parts of plaster of Paris. This is mixed with sufficient glue to make it the proper consistency and is applied with molders' tools. Another recipe provides for five parts of sifted whiting mixed with one part of glue, together with a small amount of turpentine to avoid brittleness. This is plastic when hot but hard when cold. In either case, the composition should be sheltered before placing the patterns in the sand.

THE N. C. R. CO.

DAILY FOUNDRY STATEMENT

190

C	A	B	N	ALUMINUM	SOLDER	PATTERN METAL	BRONZE PATTERNS	SAMPLE CASTINGS
1	1	1	1					

PRODUCT

C-1 .....
C-2 .....
A-1 .....
A-2 .....
B-1 .....
B-2 .....
N-1 .....
N-2 .....
Aluminum .....
Pat. Metal .....
Copper .....
Lead .....
Solder .....

C	A	B	N	LEAD	COPPER			
2	2	2	2					

PRODUCT

BACK STOCK

Bronze .....
Brass .....
Nickel .....
Aluminum .....
Pat. Metal .....
Copper .....
Lead .....

FIG. 32—DAILY FOUNDRY STATEMENT OF PRODUCT

LARGE FLYWHEELS FLOOR-MOLDED

Economies effected by making these heavy castings on the foundry floor and the advantages of this practice as compared with pit molding

BY DEPARTING from the customary practice of making large flywheels in pits, and as a result of the adoption of the floor molding method introduced by James A. Murphy, foundry superintendent, great economies have been effected in the manufacture of these heavy castings by the Hooven-Owens-Rentschler Co., engine builders, Hamilton, O. In addition, the cost of molding has been further reduced by the use of the outside ring of the mold, which might be termed the cheek, for more than one casting, and frequently four or five wheels are made from one outside ring. Two large flywheels, 18 feet in diameter, weighing 61,000 and 72,000 pounds, were molded in 57 and 72 hours respectively, the difference in time being accounted for by the saving of the wall. The cost of the common labor is also low as there are no pits to dig and the castings are easily cleaned.

Arrangement of Sweep.

The floor on which these wheels are made is provided with four permanent spindle seats for sweeping up the inside halves of the molds, while a concrete floor, equipped with one permanent spindle seat, is used for building up and sweeping the outside rings. This floor is clearly shown in Fig. 1. The outside wall of a large wheel in course of construction is shown at A, and at A′ the inside of this mold is being swept, the first coat of loam having already been applied. Inside of the large ring A is shown the outside of another fly wheel mold B, while the inside, B′, is just being started. It is common practice to have as many as three outside rings in course of construction at one time, one inside the other, and, as illustrated in Fig. 1, the sweeps, two in this case, revolve on one central spindle with one man on each working independently of each other. The outside ring B is for the mold of a flywheel 12 feet in diameter and is being loamed up for the third time.

Cores.

The cores as arranged when beginning the construction of the inside of the mold are shown at B′. A series of slab cores, concave at one end and convex at the other, are fitted together to form the bottom of the rim. The halves of the arm cores are shown in position. In Fig. 2, further progress on the inside half of a wheel mold C, is shown. In this view is illustrated the course of brick underneath the arm cores, and the sweep is in position for making the facing of loam. B′, Fig. 3, is the inside half of a mold shown in the earliest stages of its construction in Fig. 1, with the arm and hub cores in position, this half of the mold being finished ready to receive the outside ring.

Cast Iron Check Support.

The brick wall of the outside or cheek of the mold is built upon a heavy cast iron ring, as shown in Fig. 3, and this likewise forms a part of the mold, in addition to being the bottom support of the cheek. When only one casting is to be made the outside half of the mold has a 4-inch wall, but when the cheek is to be used for two or more molds this wall is made 8 inches thick. After the brick wall has been built upon the cast iron ring it is given a coating of loam by the use of the sweeps shown in Fig. 1.

Sweep for Segment Wheels.

As all of these wheels are made in halves, splitting cores must be used, and the mold must be swept up as two half circles, with spaces between them equal to the thickness of the splitting cores. By the use of various cam-shaped roller paths, wheels in six, eight or any number of segments can be made from one central spindle, and any desired shape, square, rectangular, ellip-

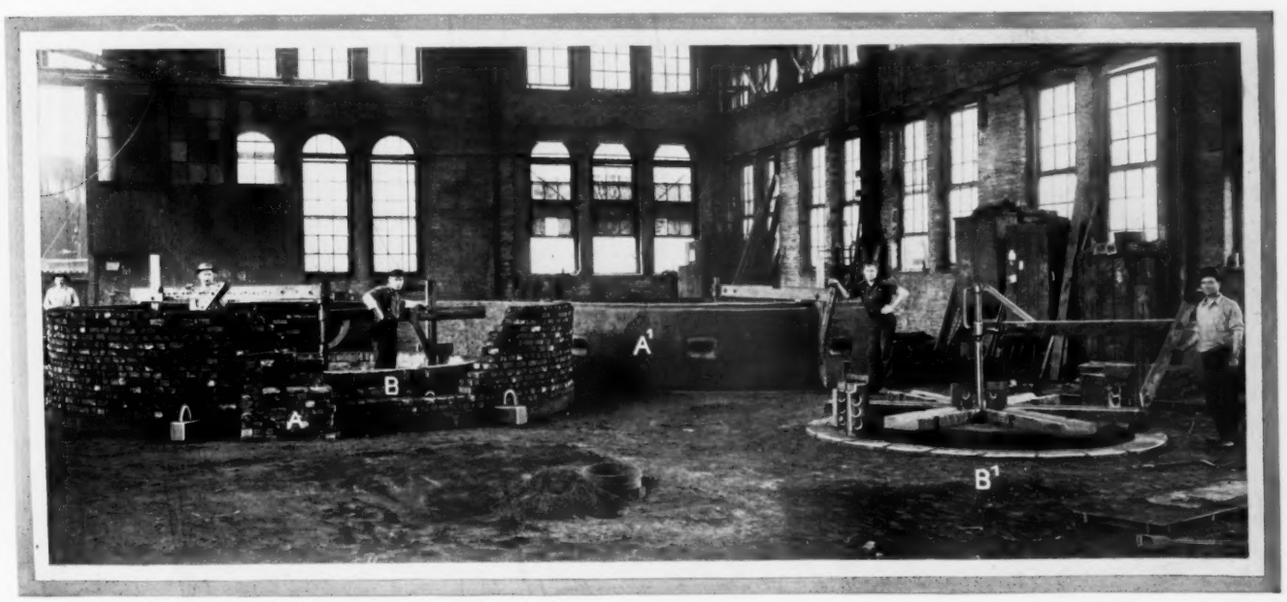


FIG. 1—FLYWHEEL MOLDING FLOOR, SHOWING OUTSIDE AND INSIDE HALVES OF MOLDS IN VARIOUS STAGES OF CONSTRUCTION

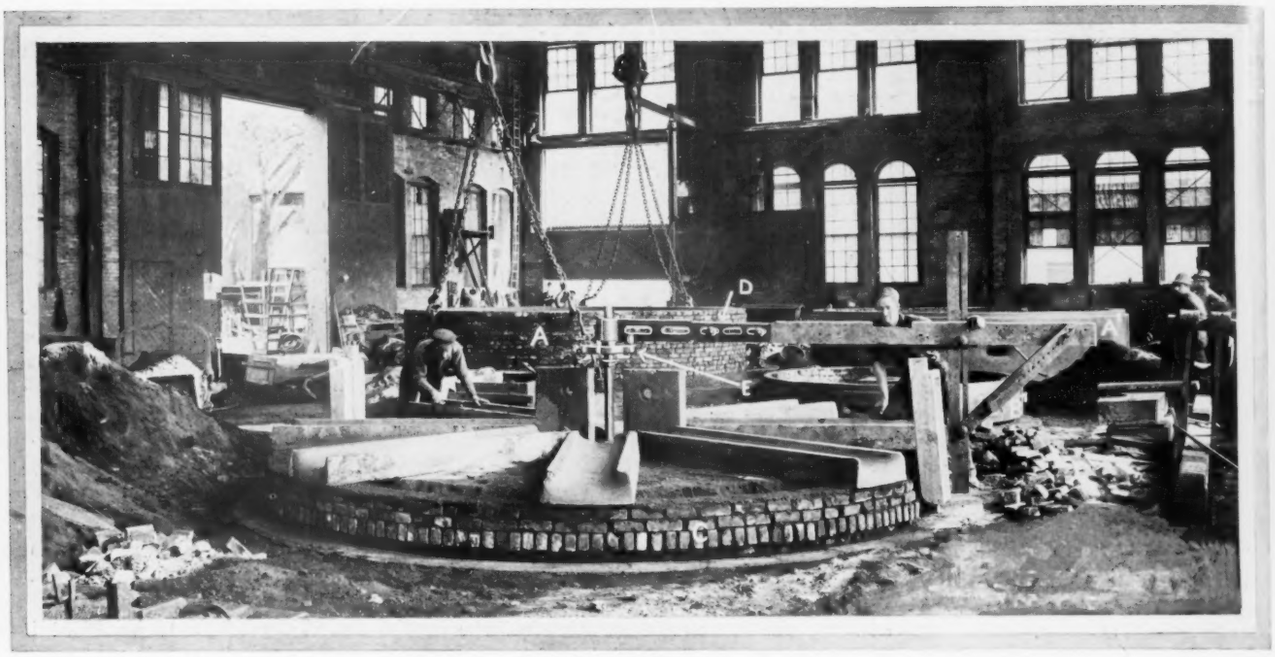


FIG. 2—SWEEPING UP THE INSIDE HALF OF A FLYWHEEL MOLD. THE HALVES OF THE ARM CORES ARE ALREADY IN PLACE

tical, etc., can be made by this method. The cam-shaped roller path is shown at E, Fig. 2, and the telescopic arm which projects from the spindle is shown at D.

Lowering the Outside Ring.

The outside ring, or cheek A, suspended from two cranes and supported at four points as it is being lowered over the inside of the mold A′, is shown in Fig. 3. As the cheek descends, measurements are taken by men at four different points to insure the proper metal thickness when the mold is closed. In this way and by the careful manipulation of the cranes, the cheek can be lowered onto the sand bed practically concentric with the interior of the mold. After the cheek has been lowered in position, the space around the outside edge of the mold is covered with slab cores and the top of the rim is formed with cores similar to those used from the bottom. Charcoal fires are used for drying both the inside and outside halves of the mold.

The interior of the mold is next rammed up with sand to prevent a

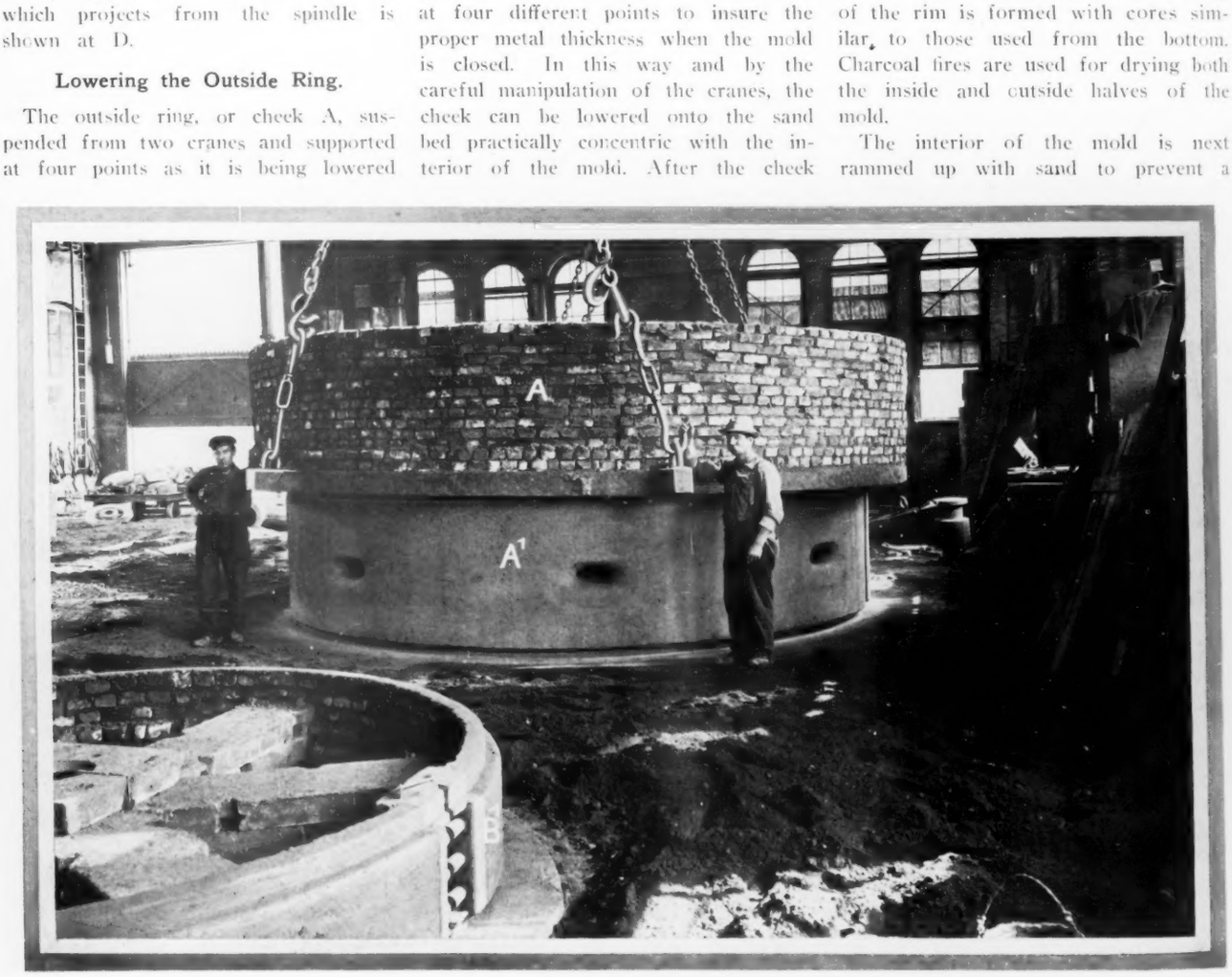


FIG. 3—LOWERING THE OUTSIDE HALF OR CHEEK OF THE MOLD OVER THE INSIDE OR DRAG

FIG. 4—FLYWHEEL FLASK MADE OF SECTIONAL CURBING BOLTED TOGETHER

runout from the arm cores and to obviate straining, while the outside portion of the mold is surrounded by steel plate, sectional curbing as shown in Fig. 4, against which sand is rammed to support the cheek. The curbing is made of ¼-inch steel plates held together with heavy cast iron bolts, slotted at the ends for wedges which are driven in place when the curbing is assembled. When the wheel has been cast these wedges can be easily knocked out and the bolts are driven into the sand, thus releasing the plates. The mold is also weighted as shown, and in this view two large ladles are in pouring position. Wheels weighing more than 60 tons, having faces up to 100 inches, have been successfully made inside this curbing above the floor without noticeable strains. Drums and other castings over 12 feet high have been similarly made and successfully cast.

The Casting.

An 18-foot flywheel in two halves, weighing 61,000 pounds with the outside wall lifted off, is shown in Fig. 5. The outside ring is to be used again for a similar wheel. No attempt whatever was made to clean the outside of this casting and the small

FIG. 5—AN 18-FOOT FLYWHEEL MADE IN HALVES. THE OUTSDE WALL HAS JUST BEEN LIFTED OFF AND WILL BE USED FOR CASTING ANOTHER WHEEL

amount of loam that adhered at the bottom of the face is clearly shown. The wheel is lifted with a cant hook and the entire floor can be cleared off in less than one hour.

Large Flask.

A large cast iron flask for engine frames of the girder type, 28 feet long and five feet wide, is shown in Fig. 6. Both halves of the flask are cast in one piece and the equipment is well designed and substantial in construction. Two of these engine beds are made each week from this flask, which is the largest of that type used in this foundry. All of the flasks for the smaller engine frames are similarly constructed. The mold shown in this illustration is ready for casting.

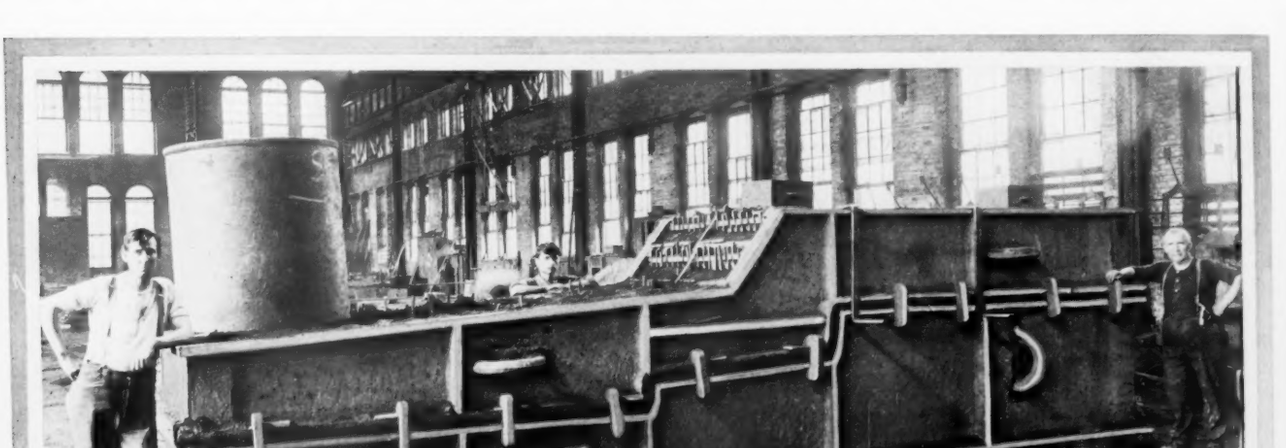


FIG. 6—LARGE ENGINE BED FLASK, 28 FEET LONG AND 5 FEET WIDE

MOLDING SAND.

BY W. J. KEEP

Question:—We are making heavy water pipe in a horizontal mold, which is poured with an end gate, and our experience with the sand secured in this vicinity is very unsatisfactory. The shipments are by no means uniform in quality. I would like to know the chemical analysis of good molding sand, so that I may be able to mix some of the local sand with a higher grade, and thereby secure practically an ideal sand. I find that the sand that can be secured in this vicinity cannot be judged by its appearance, and I would like to know what elements should predominate.

Answer:—The analysis of the high grade sand to which you refer is as follows: Silica, 80.99 per cent; alumina, 9.49 per cent; oxide of iron, 3.92 per cent; lime, 0.61 per cent. While this grade of sand is the best that can be procured for stove plate, yet for similar castings, and especially for bench work, sand of a finer grain, containing a higher percentage of binder, is preferred. For your work the sand should be of a coarser grain and should contain less binder, probably 90 to 93 per cent silica and about 6 per cent alumina would prove satisfactory.

The higher the percentage of silica, the more refractory is the sand, but it has a lower percentage of cohesion. Frequently, fine silica sand is added to a grade which contains too much alumina and is consequently not open enough for foundry use. Clay wash is sometimes added to pure silica sand as a binder and makes a very good molding sand, especially for steel castings. An excess of alumina lessens the refractoriness of the sand. Magnesia is sometimes found in molding sand, but lessens porosity to such an extent that it is undesirable for many grades of work. Oxide of iron is also undesirable, and 3 to 4 per cent is considered sufficient to ruin sand for molding purposes. Lime is still worse, and 1 per cent in the sand will do more injury than 3 per cent of iron. Lime, if present as a silicate, or as caustic lime, will combine with the silicate and alumina of the sand and will vitrify as a result of the heat of the molten metal, forming a scale on the casting. The yellow or reddish tint of molding sand is imparted by the oxide of iron. The grade of fine sand, analysis of which was heretofore given, was light yellow in color and yet contained nearly 4 per cent of iron oxide, but, notwithstanding this, this sand was exceptionally good. I believe that the best method is to use natural sands and to pay more attention to physical structure. A sharp, angular grain is more important than a slight variation in chemical composition. If a sand heap is riddled through a No. 10 mesh sieve every two weeks, it will do more good than anything else I know of. If you will write the Government Bureau of Tests at Washington, I think you can secure the results of extensive investigations on molding sands made several years ago.

Alfred Fisher, 103 W. Monroe street, Chicago, has orders on hand for the installation of the following fuel oil crucible furnaces: Hewitt Mfg. Co., for distribution in this company's plants at Topeka, Chicago, Milwaukee and Detroit, 12; Remy Co., Anderson, Ind., 10; Wolff Manufacturing Co., Chicago, 12; Rundle Spence Mfg. Co., Milwaukee, 5; Aluminum Foundry Co., Manitowoc, Wis., 6; A. H. Anderson, Chicago, 2; Union Iron Works, El Paso, Tex., 1; Detroit Sanitary Supply Co., Detroit, 4; Allyne Brass Foundry Co., Detroit, 3; Sherwood Brass Co., Detroit, 2. Mr. Fisher has increased his manufacturing facilities by opening a shop and storage warehouse at 119 Desplaines street, Chicago.

A SIMPLE FOUNDRY PRODUCTION TALLY*

A practical cost system for the casting shop which furnishes a maximum amount of information at a comparatively low cost

By C. E. KNOEPPEL

THE ONE great demand of our times, which perhaps overshadows every other, is a greater productivity, the factor upon which depends the securing of a higher degree of efficiency and increased earnings. Productivity—the relative amount produced—is not only applicable to the men on the floor or in the core room, but to the methods in use, the clerical work, the molding machines, the cupolas, cleaning room, the yard and laboring force, the selling branch of the business, the executive himself and if this factor is increased only a trifle at each point, the ultimate results can not be anything else but beneficial, in fact it is the little things which are sometimes overlooked, because they are little, that amount to something substantial in the aggregate.

It has been well said that concentration of endeavor is one of the roads to success but the necessary requirement is a knowledge just where to concentrate. What is being accomplished is perhaps apparent and evident but it is in a consideration of what can be done or what is not being done where the latent possibilities for betterment will be discovered. As nothing is large or small except by comparison, proper information regarding what is being done should be available for study in order to have a basis for judging whether results are satisfactory or otherwise. This study should not be an occasional, half-hearted, incomplete sort of an affair, but a critical, systematic analysis all along the line. By analysis is meant the thought or reasoning applied to the comparison of compiled information, enabling the executive to pick the bad from the good and arrive at some conclusion from which he can act intelligently, in fact this analysis of results is just as important to the success of the foundry as a business, as analysis of iron is to the melting operations, as a single department of the business.

DATE	REQ'D	PS. MOLDS MADE	BAL.	DATE	REQ'D	PS. MOLDS MADE	BAL.	DATE	REQ'D	PS. MOLDS MADE	BAL.
3/10	50			3/18	3		3				
3/12		10	40	3/19		3	–				
3/13		5	35								
3/14		10	25								
3/15		6	19								
3/16		12	7								
3/17		7	0								
3/17	10		10								
3/18		10	0								

The Foundry

FIG. 2—REVERSE SIDE OF MOLDING ORDER

*Presented at the Cincinnati convention of American Foundrymen's Association.

SHORTAGE RECORD.

DATE	BAD	DATE	BAD	DATE	BAD
3/12	1				
3/13	2				
3/14	2				
3/15	3				
3/16	2				
	10				
3/18	3				

FORM 87-9-09-5M

Walker Foundry Co.

MOLDING ORDER

Date 3-10-09 Symbol 18

Ord. No. 6460 Req'd 50

Patt. X621

Wanted 3-25-09

Molder 143

Remarks

The Foundry

FIG. 1—MOLDING ORDER

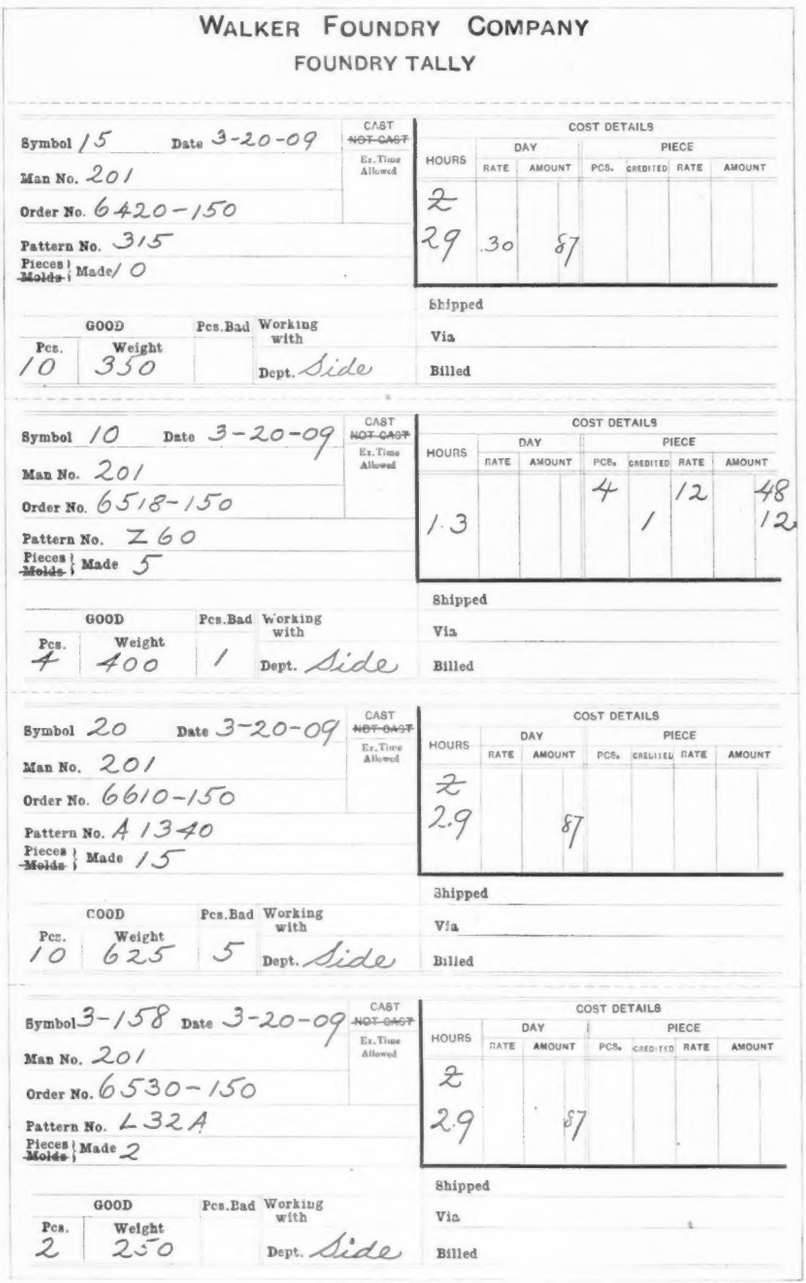
Analytical Process.

A foundryman wants to know where he has made or lost, how much and why; he wants to know how long he can consistently bid on certain classes of work; what he can do at varying productions; where his money is going, etc. This knowledge he must have if he is to strengthen the links of his business—not a link here and there, but all links. Such information is the product of this analytical process which picks to pieces all cost figures, production data, facts concerning returns, replacements, etc., all of which are not only guides but form the basis for determining in advance

what he can do in the future at varying productions.

It should need little argument to convince the foundryman that from the standpoint of good business; of possible financial gain, a full and complete knowledge of this pertinent information, properly arranged and classified for future use, is not only essential but necessary when one considers the fact that efficiency is the elimination of inefficiency, once it is found. At any rate, information should have a chance of working for the executive, not a burial which has no resurrection.

The purpose of this paper is to outline a method for collecting the principal production and cost figures with which the usual foundry is concerned, the method in question having been designed to furnish as much information from the original writing as possible and it has passed from the experimental stage to a point where it not only gives results but covers quite a little ground.



WALKER FOUNDRY COMPANY

FOUNDRY TALLY

Symbol 15	Date 3-20-09	CAST / ~~NOT CAST~~	COST DETAILS												
Man No. 201		Ex. Time Allowed		DAY			PIECE								
Order No. 6420-150			HOURS	RATE	AMOUNT		PCS.	CREDITED	RATE	AMOUNT					
Pattern No. 315			2												
Pieces ~~Molds~~ Made 10			29	.30	87										
GOOD: Pcs. 10	Weight 350	Pcs. Bad	Working with												
			Dept. Side												
Shipped															
Via															
Billed															

Symbol 10	Date 3-20-09	CAST / ~~NOT CAST~~	COST DETAILS												
Man No. 201		Ex. Time Allowed		DAY			PIECE								
Order No. 6518-150			HOURS	RATE	AMOUNT		PCS.	CREDITED	RATE	AMOUNT					
Pattern No. Z 60			1.3				4	1	12	48	12				
Pieces ~~Molds~~ Made 5															
GOOD: Pcs. 4	Weight 400	Pcs. Bad 1	Working with												
			Dept. Side												
Shipped															
Via															
Billed															

Symbol 20	Date 3-20-09	CAST / ~~NOT CAST~~	COST DETAILS												
Man No. 201		Ex. Time Allowed		DAY			PIECE								
Order No. 6610-150			HOURS	RATE	AMOUNT		PCS.	CREDITED	RATE	AMOUNT					
Pattern No. A 1340			2												
Pieces ~~Molds~~ Made 15			2.9		87										
GOOD: Pcs. 10	Weight 625	Pcs. Bad 5	Working with												
			Dept. Side												
Shipped															
Via															
Billed															

Symbol 3-158	Date 3-20-09	CAST / ~~NOT CAST~~	COST DETAILS												
Man No. 201		Ex. Time Allowed		DAY			PIECE								
Order No. 6530-150			HOURS	RATE	AMOUNT		PCS.	CREDITED	RATE	AMOUNT					
Pattern No. L 32A			2												
Pieces ~~Molds~~ Made 2			2.9		87										
GOOD: Pcs. 2	Weight 250	Pcs. Bad	Working with												
			Dept. Side												
Shipped															
Via															
Billed															

The Foundry

FIG. 3—TALLY SHEET OF A DAY'S WORK PUT UP BY MOLDERS AND COREMAKERS

Classification of Costs.

We will therefore assume, in describing the method, that in a foundry the cost arrangement provides an account number for the different kinds of work, as for instance No. 150 for molding labor, No. 151 for core labor, No. 152 for cupola labor, No. 153 cleaning room labor, No. 158 replacing bad castings made in the foundry, No. 171 repairs to plant equipment, etc.; that all production and production costs are classified according to customers' work, each customer having a separate number for identification and recording purposes and that the monthly costs are carried through the general books.

As orders are received from customers, the stenographer makes two copies, one of which remains on file in the office, the duplicate going to the office of the shipping clerk, where the foundry foreman notes the orders received and their progress as occasion demands. From the office record, a clerk makes out a molding and core order. The molding order, shown in Fig. 1, the reverse side of which is illustrated in Fig. 2, is sent to the pattern storage. The patterns and core boxes are brought out, checked and sent into the foundry, the core boxes going to the core room while the patterns are placed in racks from which the foreman or his assistant designates on the cards, the men who are to make the work called for, from which point delivery is made to the molder, the molders depositing their molding orders in little tin boxes provided for the purpose on or near their floors.

Molding Order.

Reference to Fig. 1 will show that the order in question calls for 50 castings from pattern x621. As the work is tallied each day, the number made is posted on the reverse side of the order and the balance to be made inserted, the order showing that it took six days to run out the 50 pieces. As castings which have been made are found defective, the number bad is posted as shown under "shortage record" and when the total number called for by the molding order have been made, the number bad is totaled and inserted in the "required" column as shown in Fig. 2. In this way the tally clerk knows exactly what is regular work and what is replace work, the order card showing that 63 castings were made to get 50 good ones. Another advantage is that the balance to be made is known at all times, a point worthy of consideration when another molder is given the job to finish. In addition to this the pattern is not taken to the pattern storage until the 50 good castings have been made, which does away with the work of sending the pattern to the pattern

storage after the 10 bad castings were replaced, only to find, we will say, that three of the 10 placed were found defective and must be made over again, necessitating the bringing back of the pattern.

Foundry Tally.

We will assume that the work in the foundry is all up for the day, the blast on and the men in readiness for their iron with which to pour off their work. The tally clerk takes a pad of tally sheets, illustrated in Fig. 3, which consists of perforated slips, the sheets being in original (paper) and duplicate (manila board) for molders only and in original only for all other employes. On these slips he proceeds to write up the work of each employe for the day, securing his information covering work done by molders and coremakers from the molding and core orders, posting this information to these orders as well as to the tally slips, and as he has with him a record of the bad work made the day before, he also posts to the molding and core orders, the work rejected. For all employes other than molders and coremakers, the nature of the work governs the entry to the original or paper slips.

In tallying up the work of the molders and coremakers, the clerk enters on the slips, the symbol number, date, man, order and pattern numbers, the number of pieces or molds made, the department and the actual time spent on the work. For all other employes, the clerk fills in the date, man number, account or shop order number in space "order number" and the hours spent on the work.

The slips for molders covering work put up during the day, are checked in the space provided for the purpose, as "cast" if the work is ready for pouring and as "not cast" if the work is not completed.

Should the foundry foreman allow a workman extra time, the amount of this time allowance is inserted in the space provided on slips, which must carry the O. K. of the foreman. This is shown in Fig. 4.

When two or more men are working on one job, the slip covering the work of each man shows the number of the man or men he is working with. This is illustrated in Fig. 7.

Replacing Castings.

Labor replacing castings not passing inspection is handled as new work with the exception that the symbol number is followed by the account number designating replace work and shown in Fig. 3 (bottom slip) as No. 158, the No. 150 following the order number meaning molding labor.

When the tally is completed, the clerk sends all original or paper sheets to the office while the duplicate sheets covering production are forwarded to the shipping department. The shipping clerk has two files arranged as follows:

A—For "work coming through,"

B—For "castings on hand,"

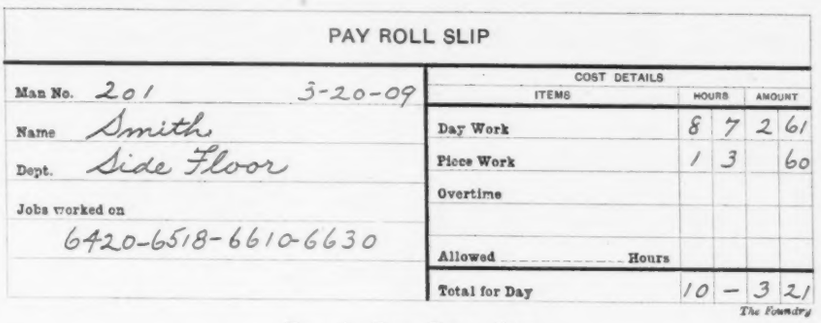
which are indexed by symbol numbers and cross indexed in some cases by name of pattern, as for instance beds, cylinders, pulleys, etc., for customers whose work is large in the aggregate. The clerk takes the sheets just received, tears the slips apart and files them according to symbol number, by pattern number and by date in the file for "work coming through." Fig. 3 illustrates a tally sheet covering the production of one employe for the day. As received by the shipping clerk, immediately following the tally, the sheet does not show the entries covering the number and weight of the pieces good, the pieces bad or the cost postings. As separated and filed, the file for "work coming through" would show along with all the other work:

10 pieces made and cast from pattern 315 for symbol No. 15.

5 pieces made and cast from pattern Z60 for symbol No. 10.

15 pieces made and cast from pattern A1340 for symbol No. 20.

2 pieces made and cast from pattern L32A for symbol No. 3.



PAY ROLL SLIP

Man No. 201 3-20-09

Name Smith

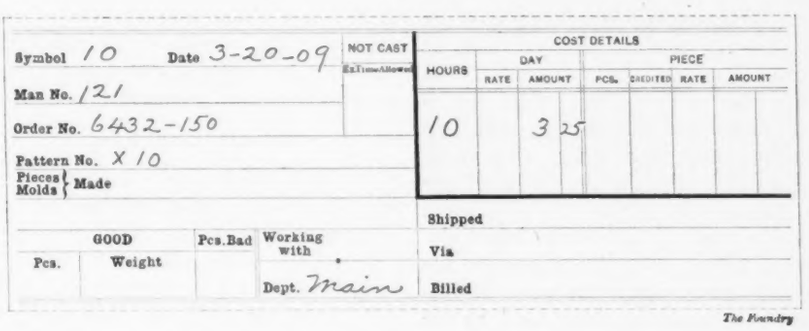
Dept. Side Floor

Jobs worked on 6420-6518-6610-6630

COST DETAILS ITEMS	HOURS	AMOUNT
Day Work	8 7	2 61
Piece Work	1 3	60
Overtime		
Allowed ____ Hours		
Total for Day	10 – 3	21

The Foundry

FIG. 4—PAY ROLL SLIP



Symbol 10 Date 3-20-09 NOT CAST

Man No. 121

Order No. 6432-150

Pattern No. X 10

Pieces / Molds Made

COST DETAILS HOURS	DAY RATE	DAY AMOUNT	PIECE PCS. CREDITED	PIECE RATE	PIECE AMOUNT
10		3 25			

Shipped

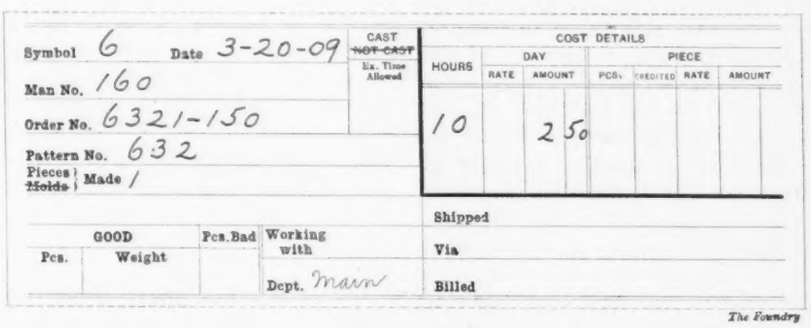
GOOD Pcs. | Weight | Pcs. Bad | Working with | Dept. Main

Via

Billed

The Foundry

FIG. 5—ENTRY ON FORM FOR CASTINGS STARTED BUT NOT FINISHED THE SAME DAY



Symbol 6 Date 3-20-09 CAST ~~NOT CAST~~

Man No. 160

Order No. 6321-150

Pattern No. 632

Pieces / ~~Molds~~ Made 1

COST DETAILS HOURS	DAY RATE	DAY AMOUNT	PIECE PCS. CREDITED	PIECE RATE	PIECE AMOUNT
10		2 50			

Shipped

GOOD Pcs. | Weight | Pcs. Bad | Working with | Dept. Main

Via

Billed

The Foundry

FIG. 6—FORM FOR CASTING PERMITTED TO REMAIN IN THE SAND 24 HOURS AFTER BEING CAST

Good and Bad Castings.

On the day following the making of the tally and after the castings have been cleaned and inspected, the inspector takes the file for "work coming through," weighs up the good castings and enters on the slips the

number and weight under "good." After this is done the postings are made from the pile of scrap covering the pieces bad. All slips to which entries have been made from the inspection, are placed in the front of the file while those slips covering work which was either not cast or cast but not cleaned are put back in their proper place in the file from which they were taken. The file is then sent back to the shipping department and the tally clerk goes through the slips in the front of the file (the results of the inspection) and makes a list of all work found defective, to be used for entry to the molding orders when the next tally is made, this same list being used by the foreman for purposes of analysis. The slips are then sent to the office, where entry as to the inspection results is made to the corresponding original or paper slips, the duplicates being marked with a letter "E" denoting entry and returned to the shipping clerk who distributes them in the file for "castings on hand." It might be well to state that the slips placed in the front of the file by the inspector, also include slips showing all the work made as bad, for the reason that such work ceases to be work coming through and while not castings on hand, should first be posted to the corresponding slips in the office and then placed in the file for "castings on hand" in order that the shipping clerk may know that the work was made and proved defective. When the slips covering the good castings replacing the bad come through, the slips for the bad work are taken up and destroyed.

Shipments.

When castings are ready for shipment, the corresponding slips are removed from the "castings on hand" file, marked with the date of shipment and the routing and as soon as the shipment is made, sent to the office where they are then used as the authority for rendering invoices to the customers. It often happens that the shipping clerk wants to make a shipment as soon as a casting is cleaned or a casting will be rushed from the foundry, cleaned as quickly as possible and shipped. In cases like this, the shipping clerk takes the duplicate tally slips from the "work coming through" file, enters the proper information and sends them direct to the billing clerk for invoicing.

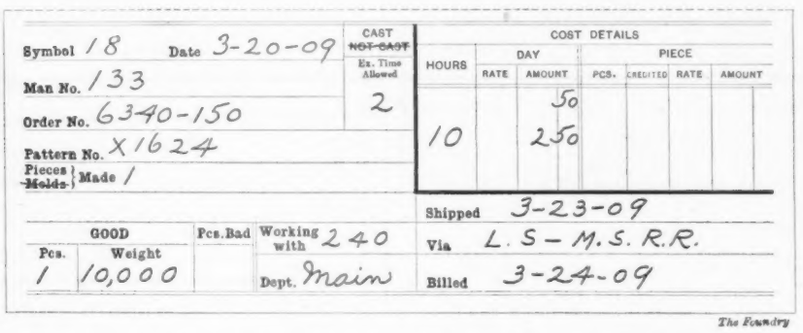

Symbol 18 Date 3-20-09 CAST NOT CAST
Man No. 133
Order No. 6340-150
Pattern No. X1624
Pieces / Molds Made 1
Ex. Time Allowed 2
COST DETAILS
HOURS | DAY RATE | DAY AMOUNT | PIECE PCS. | PIECE CREDITED | PIECE RATE | PIECE AMOUNT
10 | | 2.50 | | | | |
Shipped 3-23-09
GOOD Pcs. 1 Weight 10,000
Pcs. Bad
Working with 240
Dept. Main
Via L. S – M. S. R.R.
Billed 3-24-09
The Foundry

FIG. 7—ENTRY ON FORM WHEN MORE THAN ONE MOLDER IS EMPLOYED ON A JOB

Special Conditions.

Let us consider for a moment some of the special conditions this arrangement takes care of. Assume that a casting has been started but that it is not completed at casting time. The tally clerk would tally this work as shown in Fig. 5, showing that no pieces were made and that nothing was cast. The slip would be filed in the "work coming through" file, reference to which would show that the work was started but not completed. We will assume that on the day following, workman No. 121 spends four hours finishing up the job, which is cast the same night. The tally clerk would make out a slip and when filed it would fall in front of the slip for the 20th. On the day following when the casting is inspected and reported as good, this information would be posted to the slip for the 21st and sent to the office while the slip for the 20th, which is no longer of any use, is destroyed by the shipping clerk. Here we have a complete history of the transaction for we have first a knowledge that the work was started but not completed; then completed and cast but not inspected and finally inspected, reported as good and ready for shipment. On the other hand, should this casting have taken four days to make, there would be duplicates on hand in the file for "work coming through" for the 20th, 21st, 22d and 23d, the one for the 23d showing that the work was made and cast and when reported as good, the other three slips would be destroyed.

Another Special Case.

Let us consider a case where a large casting is made and cast the day it was started, as shown in Fig. 6, but that it remains in the sand during the following day. The slip would be filed with "work coming through" and on the 21st would be taken with the others in order to post the results of the inspection. In going through the list, the inspector finds that no such casting was cleaned. He therefore puts it back in its proper place in the file and if any reference is made to it on the 22d the slip will show that the work was made and cast on the 20th, not cleaned and reported as good on the 21st and until the inspection is made in the after-

PAY ROLL WEEK ENDING March 20, 1909.

MAN NO.	NAME	MONDAY	TUESDAY	WEDNES.	THURSDAY	FRIDAY	SATURDAY	SUNDAY	TOTAL	DEDUCTIONS	NET
				MOULDERS							
4#	Williams	3.20	3.20	3.20	3.20	3.20	3.20		19.20*		
5#	Smith J.	2.00	2.00	2.00	2.00	2.00	2.00		12.00*		
6#	Jones	1.50	1.50	1.50	1.50	1.50	1.50		9.00*		
7#	Jenkins	2.60	2.60		2.60	2.60	3.00		13.40*		
8#	Peters	2.75	2.75	2.75		.68	1.50		10.43*		
9#	Wilkins	3.50	3.50	3.50	3.50	3.50	3.50		21.00*		
10#	James	2.00	2.00	2.00	2.00	2.00	2.00		12.00*		
				CORE-MAKERS					97.03*		
12#	Lyons	3.25	3.25	3.25	3.25	3.25	3.25		19.50*		
13#	Carlson	4.20	1.16	4.25	5.10	2.60	1.20		18.51*		
14#	Frank	2.50	1.60	1.20	3.00	2.50	3.20		14.00*		
				CHIPPERS AND CLEANERS					52.01*		
20#	Brown	1.75	1.75	1.75	1.75	1.75	1.75		10.50*		
22#	Smith T.	1.50	1.50	1.50	1.50	1.50	1.50		9.00*		
				CUPOLA MEN					19.50*		
25#	Andrews	1.50	1.50	1.50	1.50	1.50	1.50		9.00*		
26#	Kehr	1.75	1.75	1.75	1.75	1.75	2.10		10.60*		
				LABORERS					19.60*		
30#	Jamison	1.25	1.25	1.25	1.25	1.25	1.25		7.50*		
31#	Lewis	1.50	1.50	1.50	1.50	1.50	1.50		9.00*		
32#	Crane	1.75	1.75	1.75	1.75	1.75	1.75		10.50*		
33#	Green	1.75	1.75	1.75	1.75	1.75	1.75		10.50*		
									37.50*		
									225.64*		

The Foundry

FIG. 8—WEEKLY SUMMARY OF PAY ROLL

AIR VELOCITY TABLE.

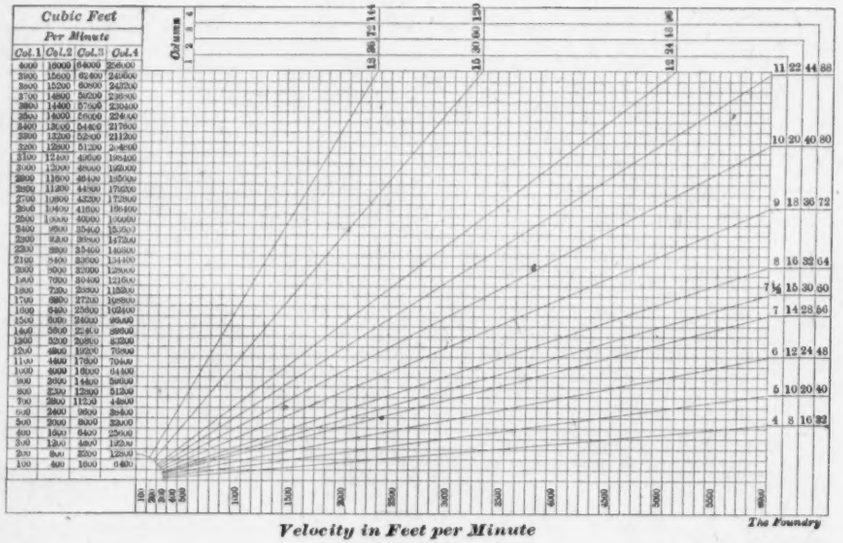
This table is used for figuring the lineal velocity of air through a pipe when the cubic feet per minute and diameter of pipe are known, or for finding any of the factors when the other two are known.

The table solves the formula, velocity in feet per minute $= \frac{\text{Cu. ft. per minute.}}{\text{Area pipe in sq. ft.}}$

Blower pipes are usually proportioned for a velocity of 3,000 feet per minute.

For handling material by air in pipe, the velocity should be between 4,000 and 6,000 feet per minute, according to the size of the pipe and the density of the material.

Pipe Diameter in Inches



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AIR PRESSURE TABLE.

This table gives directly the pressure needed to transmit a given quantity of air through a pipe 100 feet long and solves the formula:

$$p_1 = \frac{Lv^2}{2500d} \text{ or } p_1 = L\left(\frac{\text{cu. ft.} \times 144}{60 \times d^2 \times 0.7854}\right)^2 \div 25000d$$

making L = 100 feet.

and q = Cubic feet per minute.
p_1 = Ounces per square inch.
d = Diameter pipe in inches.

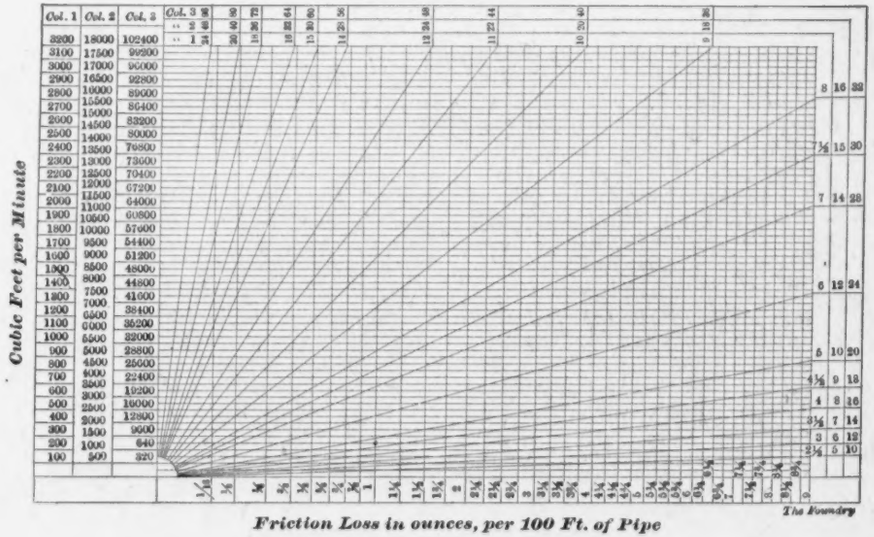
$$q = 5.176\ d^2\sqrt[2]{p_1}$$

For any other length not exceeding 2,000 feet, multiply loss by the number of hundred feet of length.

Add for elbows, as follows:

No. pipe diameters in elbow radius.....	5	3	2	1½	1¼	1	¾	½
Equivalent feet of straight pipe.....	7.8	8.4	9	10.3	12.7	7.5	35	121

Pipe Diameter in Inches



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Note--This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note-book form.

THE FOUNDRY DATA SHEET, AUGUST, 1909.

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication.

noon, the work in question is still in an unfinished condition. This illustration also applies to cases where work is made and checked as cast but not poured because of a shortage of iron. A follow-up from the tally slips will show whether the work was made but not cleaned or made and not cast.

Card for Two or More Men on One Job.

Let us assume, as shown in Fig. 7, that workman No. 133, assisted by No. 240, made and cast pattern X1624 on the 20th for symbol 18, in 10 hours, each being allowed two hours extra for making the piece in one day; that it remains in the sand during the 21st, is cleaned on the 22d and shipped on the 23d over the L. S. & M. S., and billed on the 24th. Any reference to the file on the 20th for this particular job, up to the time of the tally, would show that the work was not made, although the foundry would report it as being in process if an investigation were made. After the tally has been made for the day, however, and the slips torn apart, the "work coming through" file would contain the slip for this job, showing that it was made and cast. When the inspection is made on the 21st, the casting in question would not be found and the slip would be put back where it was taken from, any reference to it on the morning of the 22d still showing it as work coming through. After the inspection on the afternoon of the 22d, the weight would be entered, the slip sent to the office along with the others, the weight transferred to the original, returned to the shipping clerk who would file it in the "castings on hand" file where it would remain until shipment was made, from which point the procedure is as previously outlined.

In cases where castings which have been reported as good, slips for which are in the "castings on hand" file, are subsequently found defective before being shipped, the slips are removed, marked "scrapped" and sent to the office for charging to the scrap account, for the scrap value, while the castings would be either taken to the scrap pile or the cupola.

Office Entries.

Let us now follow for a moment the procedure in the office. The foundry clerk on the morning following the making out of the tally, takes the original or paper slips which have been sent to him and proceeds to enter the cost details. From his record of piece prices and day rates, he extends the earnings for the day as shown in Fig. 3, the top slip showing that workman No. 201 earned 87 cents for the 2.9 hours charged against symbol No. 15. In explanation of the change in hours on the top slip, from 2 to 2.9 hours, it would be well to state that a conversion table is used when posting earnings to the molders' slips, in order to convert actual molding time into the full time for which the molder is paid. For instance, a molder spends eight hours of his day on four jobs of two hours each, the other two hours being spent in cutting over the sand in the morning and pouring off and shaking out the work at night. As the cost of this two hours time is as much a part of the cost of the four jobs as the direct molding cost, each job must necessarily absorb a certain amount of this extra time and inasmuch as it would be difficult for the molder to state how much of this time is applicable to each job, an equal amount is added to each, making the molding time 2.5 hours instead of two hours. The conversion table is figured at various combinations of direct molding time from six to nine hours, for various job times from one to 10 hours and their fractions in tenths of hours.

Time Allowances.

When piece workers lose work for which the foreman decides to pay them, the foundry clerk is notified. For instance, the second slip in Fig. 3 shows that of the five made, four were good and entered in the "piece" column but as the foreman decided to pay the molder for the bad casting, the foundry clerk enters it under "credited" both of which are extended at the piece prices. Time allowances are shown in Fig. 7.

After all the slips have been rated, extended and checked against the "in" and "out" clock tickets in order to make the times agree, the foundry clerk takes a pad of pay roll slips, illustrated in Fig. 4, and enters the man number, date, name of workman, department and jobs worked upon, after which he brings down the amount of the earnings in time and value. For instance, the illustration, which is the pay roll slip for tally sheet, Fig. 3 shows that No. 201 earned $3.21 for the day, made up of $2.61 day work and 60c piece work. Time allowance is not entered in the regular time column for the reason that such time is not actually spent on the work and if entered would result in a greater number of hours which would show a smaller production per hour than was the case. The value of the time allowance is of course included in the cost of the work. After the payroll slips are made out, the foundry clerk then tears the tally sheets apart and files the slips according to symbol, by pattern and date, while the pay roll slips are filed according to workmen, by date. The tally slips show no production results inasmuch as they are being rated, extended and filed

PAY ROLL DISTRIBUTION.

WEEK ENDING MARCH 20, *1909.* MOULDING

SYMBOL	DAY WORK			PIECE WORK			REPLACE WORK		
	WEIGHT	HOURS	AMOUNT	WEIGHT	HOURS	AMOUNT	WEIGHT	HOURS	AMOUNT
	*		*	*		*	*		*
10#	5000	100	25.00	1980	33	10.00	300	6	1.50
21#	10000	150	45.00	2000	40	12.00			
23#	18500	225	60.75	5000	100	30.00	1000	20	6.00
30#	75000	850	233.75	5000	125	37.50	2500	50	12.50
32#	10000	200	40.00						
33#							1000	20	4.00
35#	125000	1520	275.00	10000	125	40.00	15000	167	33.40
40#	50000	500	125.00						
TOTALS	293500 *	3275	804.50 *	23980 *	423	129.50 *	19800 *	263	57.40 *

GRAND TOTAL

*		*
293500	3275	804.50
23980	423	129.50
19800	263	57.40
337280 *	3961	991.40 *

The Foundry

FIG. 9—PAY ROLL DISTRIBUTION SHEET

while the castings are being cleaned prior to the inspection. It can therefore be seen that in the payroll file, we have the earnings for No. 201 for the day and in the production file we have later in the day, all the information concerning his production and his time and cost to produce while the same information as to production is also on file in the office of the shipping clerk as castings on hand and ready for shipment.

SUMMARY OF MOULDING MONTH OF MARCH 1909.

ITEMS	WEIGHT	HOURS	AMOUNT	WEIGHT	HOURS	AMOUNT	WEIGHT	HOURS	AMOUNT
SYMBOL			10#			12#			15#
	*		*	*		*	*		*
DAY WORK	10000	110	25.30	50000	600	180.00	40000	800	160.00
PIECE WORK	3500	50	12.50	10000	125	31.25			
REPLACE	600			5000			5000		
TOTALS	14100 *	160	37.80 *	65000 *	725	211.25 *	45000 *	800	160.00 *
SYMBOL			18#			20#			21#
	*		*	*		*	*		*
DAY WORK	100000	1000	250.00	2000	65	19.50	5000	145	39.15
PIECE WORK	10000	80	24.00	2000	70	21.00	2000	40	12.00
REPLACE	4000			1000			1000		
TOTALS	114000 *	1080	274.00 *	5000 *	135	40.50 *	8000 *	185	51.15 *
SYMBOL									
DAY WORK									
PIECE WORK									
REPLACE									
TOTALS									
SYMBOL									
DAY WORK									
PIECE WORK									
REPLACE									
TOTALS									
SYMBOL							GRAND TOTAL		
							*		*
DAY WORK							825000	13000	3360.00
PIECE WORK							110000	1500	420.00
REPLACE							80000		
TOTALS							1015000 *	14500	3800.00 *
SYMBOL									
DAY WORK									
PIECE WORK									
REPLACE									
TOTALS									

The Foundry

FIG. 10—SUMMARY OF MOLDING COST

Duplicate Slips.

The duplicate slips which are sent to the office following the inspection and which bear the number and weight of the pieces good and the number bad, are taken by the foundry clerk and the production information transferred to the originals on file, the duplicates being marked with a letter "E" denoting entry to the original slips. As was previously stated, slips are sometimes sent direct to the office for invoicing purposes, instead of to the foundry clerk. After invoicing, all slips are handed to the foundry clerk who rapidly runs through them and when he finds any which have not been marked with the letter "E" he knows that shipment was made previous to the regular inspection, so proceeds to transfer the information they contain to the originals which will show an absolute check of one slip against the corresponding slip. After all slips covering shipments made are checked over by the foundry clerk, they are filed according to symbol, by pattern and date, for subsequent reference.

Weekly Pay Roll.

We now come to the third section of the work in question—that of making up the weekly payrolls and summarizing the costs of production. In connection with this feature of the work, it might be well to state that in order to make this method cover as much ground as possible and do away with all unnecessary recaps and distributions, an adding machine was employed, which adds weight, hours and value at one operation. The machine can be arranged to make possible, group and sub-totals in addition to the grand totals.

It will be remembered that in the office there are two files containing:

Pay roll slips filed by workmen by date and showing daily earnings.

Cost and production slips filed by symbol according to pattern by date and showing weight of good castings, hours and cost to produce—the slips covering all expense, labor being properly classified according to account number.

At the end of a pay roll period, the clerk takes the pay roll slips from the file, inserts in the adding machine a sheet as shown in Fig. 8, and lists by man number, the daily earnings under the proper day. In printing the total earnings for the week, the group total key is pressed which at the same time transfers this total to an accumulating device and when ready to take off the total of the classification, the operator presses the grand total key, which prints the amount as shown, namely $97.03 for "molders". In this manner the clerk goes through all of the payroll slips, the record showing the earnings by workman as well as by classification of labor. To ascertain the total pay roll, the clerk simply lists the group totals, presses the grand total key and the result is the payroll for the week, shown in the illustration as $225.64. Names are then written in—the man number being printed by the machine through the use of an eliminating key and when the time comes for paying the men, this adding machine record is the only record used, pay envelopes filled or checks written from the total earnings as shown at the right of the sheet.

Distribution of Pay Roll.

After the pay roll record has been made but before the men are paid, the distribution of the pay roll (consisting of all tally slips) is then made, which is done in order to maake one file balance with the other. This distribution is made according to molding, coremaking and indirect or expense labor, the molding and coremaking labor being in turn classified according to day work, piece work and replace labor, while the indirect labor is classified according to account labor number. A sheet, as shown in Fig. 9, is inserted in the machine for molding labor, we will say, after which the clerk takes the slips

filed behind the first symbol number and with the carriage of the machine thrown back, lists the slips showing day work molding labor—weight, hours and value being added at one operation—laying the slips which have been listed in a pile by themselves, face down. When he has listed the last slip covering day work molding labor, he brings the carriage towards the machine and prints the results as shown, namely 5,000 No.—100 hours—$25.00 for symbol No. 10. The clerk then moves the carriage so that the figures will fall in the "piece work" column, after which he lists the piece work results (weight, hours and value), makes the addition, namely, 1980 No.—33 hours—$10.00 for the same symbol and after moving the carriage, adds the replace work, the result being 300 No.—6 hours—$1.50—the carriage being thrown back when listing the slips but brought forward when printing the totals.

The foundry clerk has in one file, the tally slips which have been through the machine and which he files in a transfer drawer. He also has in a separate pile, the slips for the same symbol which have not been put through the adding machine, this pile representing the core labor. These slips he places back in the current file for use when making the core labor distribution. The sheet for the molding labor distribution is then turned up one space and the carriage moved so that the figures will fall in the "day work" column after which he follows the procedure as above outlined for the next and all succeeding symbols. After this work is done, the columns are added vertically and the results printed as shown in Fig. 9, the footings being so transferred as to give the total for the week of the weight produced, the hours and the cost, as shown at "X" under "grand total."

Core Labor.

The clerk then makes the core labor distribution by symbol numbers, in the same manner as the molding distribution was made and when this is done, all slips covering molding and coremaking will have been removed from the current to the transfer drawer, leaving in the current file, tally slips covering indirect labor, which are distributed by account or shop order numbers after which the three sheets are totaled for checking against the pay roll sheet for the week, which totals should agree. These distribution totals are also used for furnishing information weekly as to the production secured and the direct and indirect labor cost to produce.

At the end of the month, after the last payroll distribution has been made, the monthly cost and production summary is started. The clerk takes the four or five sheets covering each of the three divisions—molding, core and indirect labor—and proceeds as follows: A sheet as illustrated for molding in Fig. 10, is placed in the machine and from four or five molding distribution sheets, the clerk lists by symbol number, from the "day work" column, the weight, hours and amount, printing the total opposite "Day Work" by pressing the group total key. The piece work and replace information, for the same symbol, is then listed and printed as shown, after which the grand total is printed opposite "Totals" by pressing the grand total key—the illustration showing that for symbol No. 10, the total for the month is 14,100 per cent of production at a molding cost of 160 hours and $37.80. This same procedure is followed until all the information as shown by the four or five molding sheets is summarized by symbol, shop order or account number on the summary of molding. The clerk then takes this summary sheet, adds across the page, first the day work, then the piece work and finally the replace work results, pressing the group total key in each instance. Pressing the group total key gives the result as shown at "X" under "Grand Total," Fig. 10. After the molding summary is completed, the clerk then makes the summary of core and indirect labor in like manner.

We now have according to symbol, the monthly production; hours and value of molding labor; hours and value of core labor and the value of all indirect labor, properly classified. These figures are handed to the bookkeeper, who posts the total molding labor to the molding account, No. 150, the total core labor to the core labor account, No. 151, and the other items in their respective accounts. He then posts the details covering production, as shown by the summary, to symbol sheets, as illustrated in Fig. 11 (see entries under March).

General Summary.

From the cupola reports, the metal cost is figured and entered; the material requisitions give the cost of all indirect materials used; the bookkeeper has posted all general expense items, after which all costs are gathered according to:

Direct charges.

Expenses apportionable to direct labor.

Expenses apportionable to tonnage produced.

These are then brought to a controlling account "Total Cost," the rates ascertained and applied on direct labor and tonnage, extended and totaled as shown in Fig. 11, the result being the total cost to produce 114,000 per cent for symbol No. 18 for March, namely $1,992 or $1.75 per 100 per cent—the production being at the rate of 1,055 per cent per molder per day—

WALKER FOUNDRY CO.

Form 81 A—1 M PRODUCTION OF CASTINGS Order No. Symbol No. 18

	JANUARY	FEBRUARY	MARCH
FOR MONTH OF			
WEIGHT PRODUCED	110 000#	75.000#	114 000#
Metal Cost	Per 100 Lbs. 90 — 990 00	Per 100 Lbs. 675 00	Per 100 Lbs. 1 026 00
Molding - Pro. Labor	Hours 1375 — 343 75	Hours 857 — 214 25	Hours 1080 — 270 00 X
Coremaking " "	200 — 50 00	140 — 35 00	210 — 54 00 X
	1575 — 393 75	997 — 249 25	1290 — 328 00
Expense on Pro. Labor	% 110 — 433 15	% — 274 18	% — 360 80
Expense on Tonnage	Per 100 Lbs. 20 — 20 00	Per 100 Lbs. — 150 00	Per 100 Lbs. — 225 00
Expense for Rigging			
Shop Cost	Per 100 Lbs. 1.85 — 2 036 88	Per 100 Lbs. 1 348 45	Per 100 Lbs. 1.71 — 1 942 80
Commercial Expense on Pro. Labor	% 15 — 39 06	% — 37 39	% — 49 20
Total Cost	Per 100 Lbs. 190 — 2 095 94	Per 100 Lbs. 1.85 — 1 385 82	Per 100 Lbs. 1.75 — 1992 00
Produced per Molder per Day	800	875#	1055#
Average Pro. Labor Rate	25	25¢	25.4¢
Weight Castings Replaced	8800	4000	4000# X
% " "	74	51	34
Cost to Replace Castings			

REMARKS:

The Foundry

FIG. 11—GENERAL SUMMARY OF COST OF PRODUCING CASTINGS FOR ONE MONTH

a study of which will show the value of the statement for analytical as well as cost purposes.

Conclusion.

A few words in closing as to advantages and disadvantages. The method no doubt has certain faults but they are more than offset by the results accomplished. To one who does not view the scheme in its entirety, the matter of rewriting would be considered a serious fault, in fact this criticism has been advanced. This consists in entering the date, man number and department on all tally slips other than the first one, for each man; the copying of the inspection results from duplicate to original and transferring the information from the tally slips to the left hand side of the pay roll slips. Against this can be advanced the argument that the time saved in other places more than pays for the time spent in rewriting. In this connection, consideration should be given to the fact that from the sending of the molding and core orders to the shops, until the final entry on the form illustrated in Fig. 11, the results listed are accomplished through the use of tally and pay roll slips only—the bulk of the work after the entries have been made, being their sorting, filing, handling and feeding the information to a machine—a feature of the work which is not only rapid but accurate, so that the matter of rewriting is really of small moment, everything else considered.

Another might find serious fault with the method because of the large number of slips handled in the course of a month and the possibility of losing or mislaying some of them, and while it would be just as consistent to advance the argument that our present bank checking system should be discontinued for the same reasons, it might be said that it is because of the unit plan that the method is so comprehensive and that the chances of losing both slips covering the same work is rather remote. If a slip is lost or misplaced, it is not a difficult task to find the corresponding slip and make a duplicate.

Accomplishments of the Systems.

Let us see what the method really accomplishes:

First—It acts as the means of tallying up the work done by each employe each day.

Second—It shows the time spent on all work done each day.

Third—It transfers automatically, the work of each employe, without regard to the number of symbols or account numbers effected.

Fourth—It shows the work which has been started but not completed—work in process.

Fifth—It shows the work made and cast but not inspected—work coming through.

Sixth—It shows the work made, cast, inspected and ready for shipment—an inventory of manufactured castings on hand, in balance at all times.

Seventh—It furnishes the means of planning and making shipments.

Eighth—It furnishes the authority for invoicing shipments made.

Ninth—It furnishes the file of castings shipped, by date of shipment.

Tenth—It shows the daily earnings of each employe, whether paid by day, piece or premium plans.

Eleventh—It acts as the means of making up the pay rolls.

Twelfth—It shows from day to day, the production and cost of all work, by castings, symbol or account.

Thirteenth—It shows from day to day the amount and cost of replaced work.

Fourteenth—It provides the means for taking care of all time allowances and credits for spoiled work through no fault of the workman.

Fifteenth—It provides the means of furnishing the executive with weekly distributions of results accomplished.

Sixteenth—It forms the basis of making up monthly costs according to any classification desired by the foundryman—whether by pattern, customers' work, departments, light, heavy and medium work; by workmen, floors, machines, classified weights, etc.

Advantages.

The principal advantages which the method possesses is that it furnishes a maximum amount of information at a consistent expenditure of time and money; it provides the executive with an excellent follow-up arrangement; it reflects the conditions in the shops, at all times, both as regards production and cost; it is elastic in that it can be made to fit the requirements of any foundry or the wishes of the executive; it furnishes information which is on tap in get-at-able shape and is current and not ancient history; it furnishes clear and concise records, weekly and monthly, as to results; it enables the executive to secure his information with rapidity and dispatch, owing to the rapidity with which the machine handles the figures. In short the method provides the executive with at least one means of conducting his business, with the same care "to the machine shop door" as is usually exercised "from the machine shop door."

CAST IRON PIPE.

By W. J. KEEP

Question:—In casting pipe of various diameters and thicknesses in a horizontal position, I find almost invariably on the top surface of the casting a number of holes or cavities covered by only a thin film of metal. This film when broken through shows holes having a smooth surface which would probably be caused by imprisoned gas. Venting the top part of the mold seems to have little or no effect. Can you tell me the possible cause and prevention of this difficulty?

Answer:—The blow holes are caused by gas arising from the core, and venting the top part of the mold would not overcome this difficulty. I presume that you make your cores in the same way they are made in the United States, using a hollow arbor about ½-inch less in diameter than the diameter of the core. This arbor contains many small short slots which are made by setting sand cores all over the surface of the mold in which it is made, and when placing the core in the mold a hollow cast iron arbor is produced which is open at both ends and perforated throughout. This arbor is wet with clay wash and is revolved under a thin sheet of molding sand which drops on it. A straight edge is set so as to strike out the sand surface the required size of the core. This green sand core is set in the pipe mold, the ends being left open. Very little gas will be generated by making the core in this way and the gas will flow through the slots in the arbor and out of the open ends. I believe you will find that your core is not sufficiently vented through the arbor.

CLAY-LINED CRUCIBLES.

Special grades of steel for electrical work are now being melted in clay-lined, graphite crucibles in many plants. The use of these crucibles prevents the steel from taking up carbon from the graphite, as it does when the graphite is exposed. The danger of breakage, as a result of the clay lining, is also greatly reduced, and these pots can also be used to advantage for melting nickel for rolling and nickel alloys.

PRODUCTION OF MALLEABLE CASTINGS

The use of the pyrometer in the annealing department--- The final finishing operation---Wet and dry galvanizing

By RICHARD MOLDENKE

IN MODERN practice it is essential that in conducting an operation advantage be taken of every safeguard that may be available. Hence in every annealing room there should be a good pyrometer to keep track of the oven temperatures. The eye is not reliable enough for this purpose, and is the cause of much trouble in the old-fashioned plants. Probably the only guide the eye has is to note the cracks in the brick-work which, when appearing as white lines on a red back-ground, indicate to the experienced operator that his temperature is about right. As the men detailed for this purpose are apt to get old in service, the eye loses its sensitiveness, and the result is either the under-annealing or over-annealing of the work. There are quite a number of pyrometers on the market but some types become unreliable when long in use. The Siemens pyrometer depends upon a given weight of water at normal temperature to which the zero of the scale is set, and into which a ball of copper, heated to the temperature of the annealing pots, as previously explained, is dropped. The resulting temperature, obtained under suitable precautions, sends the mercury thermometer of the instrument up to a point readily read off on the scale, and gives the temperature of the copper ball. The weight of the water is in fixed proportion to the weight of the ball, and hence this can change to a small extent without affecting results. As the balls scale off perceptibly, new ones of proper weight are substituted, and unless carelessly handled this instrument remains serviceable for a long time and is absolutely reliable. The objection, however, is that it takes some time to get the readings. The copper ball must be held against the pot by an iron rod into the end of which it is inserted. It must remain in the oven about 15 minutes to properly acquire the temperature. Unless the test is conducted quickly and accurately, heat is apt to be lost, and the readings naturally will be low. The advantage is that the instrument is comparatively cheap, unless by carelessness thermometers are broken.

Le Chatelier Pyrometer.

The Le Chatelier pyrometer, on the other hand, depends upon the generation of a feeble current of electricity when metals or alloys of different kinds are joined together, and the junction is heated. This current is directly proportional to the degree of heat, and hence when measured by a suitable galvanometer, becomes very accurate and sensitive. While the Siemens pyrometer gets the true temperature within 25 de-

MALLEABLE FITTINGS EMPTIED OUT OF ANNEALING POTS

grees Fahr., the Le Chatelier comes within 10. The objection is the rather large first cost of a proper instrument, for unless the very best of this class is taken, troubles eventually crop up by reason of parasitic currents which develop in the platinum and platinum-rhodium alloy wires used.

Dumping the Pots.

After the annealing has been completed, the pots are allowed to cool and then withdrawn from the ovens. They are next dumped on the iron floor of the packing space, and the castings picked out of the scale. This is shown clearly in the accompanying illustration. Naturally, some of the scale will adhere to the castings, and hence in some works a preliminary tumbling is given them to free them from this material and at the same time to save it. Usually, however, the castings go directly to the soft rolling room, where they either are placed in a number of the regular style rolling barrels, or else into a long one set on an incline, the uncleaned casting going in on one end, and coming out cleaned at the other.

The very best material to add with the castings in these soft-rolling barrels is the broken pieces of annealed castings, such as test plugs, and defective annealed work not liable to be mistaken for good. This rubs off the scale, and by reason of the contained graphite (temper-carbon is really amorphous graphite and acts like such when used as a polishing medium) imparts to the castings a beautiful, glossy black finish.

Finishing Department.

The castings are now ready to go to the finishing departments. Depending upon the care originally exercised in the various preceding processes, there will be more or less work to be done before the castings can be shipped. Thus, with careless molding, castings will be over-weight, not true to pattern and the like. Careless trimming leaves much expensive work to be done in the grinding room to clean off fins, gates, and other excrescences, spoiling the appearance of the work. Bad packing leaves the castings warped, if not with wasted edges and corners; and so previous sins are all brought home to the detriment of low shop costs when the castings come from the soft-rolling room.

Chipping Department.

We therefore find in every establishment to a greater or smaller extent a chipping room where the rougher work is done in the vise by hammer and chisel; then the grinding room, where the lighter corrections are applied; finally a straightening department where this work is attended to, as well as special jobs are gone over, such as getting pipe rings to true shape, forcing arbors through holes to make them pass the inspector's requirements as per specifications, etc. Here also are bent any castings, to their required shape, which are found advisable to cast straight originally.

The castings now go to the shipping department or warehouse, as the case may be, under ordinary conditions. Oftentimes, however, it is necessary to galvanize or tin the work, and then the castings, after passing all the departments and being pronounced perfect, are subjected to these processes.

Galvanizing.

In the case of galvanizing, where we have to deal with baths that are too high in temperature, it very often happens that the work comes out too hard to thread afterwards. The temper-carbon has gone back again, and a hard casting has resulted. While this may be avoided by changing the composition in various ways, or in other words applying metallurgical tricks, it is not a good policy. If the work were properly made in the first place, the composition correct, the metal not injured by oxidation, and the zinc bath not too high in temperature, the castings will remain soft enough to machine. It is advisable to introduce a second pickle between the first and the galvanizing. Thus, if either sulphuric or hydrofluoric acid is used for the first bath, a second with hydrochloric acid prepares the iron much better for the hot galvanizing than if the first pickle only were used.

Dry Galvanizing.

Probably in no place will the introduction of the Sherardizing process be of so much value as for galvanizing malleable castings. This rolling of the work with zinc dust at temperatures below the melting point of that metal, will give the malleable casting a better chance than is the case at present. Furthermore, the zinc penetrates deeply into the body of the casting, and as such work is never used for important purposes, but rather only where protection from rust in addition to tightness against leaks is required, the probable loss of some of the strength by such penetration of the zinc will not matter materially.

For special classes of work the soft-rolling is carried out so carefully, by using leather scraps, old shoes and the like, that this not only cleans, but polishes the castings so nicely that they can subsequently be tinned, nickeled, and even silver and gold plated, making the finest kind of art work, in which strength is combined with ease and cheapness in the making. Here the art blacksmith is done away with, and one piece is like another.

A GLUING STAND FOR SMALL SEGMENT WORK

By H. N. TUTTLE

MOST pattern shops have a lathe tripod which is used when turning large work outside the headstock. This tripod is seldom in use, and may be utilized as a stand for gluing small segment work. A casting A, Fig. 1, made the proper size to fit the tripod B, with the top or head approximately 4 inches in diameter, is provided with a hole tapped in the upper end to fit a ½-inch cap screw. The top surface of this casting is preferably faced. The part C, upon which the segment work is glued, has a ½-inch hole through the center for the cap screw D. The open hole in A should be tapped to a tight fit for the set screw, so that the same will not move when turning the bottom board C while applying the clamps. The work is clamped by hand screws, and any number of jobs may be done at one time by having a separate bottom board for each one.

Gluing Press.

Fig. 2 shows a gluing press upon which very rapid work may be done and requires no hand screws. The top of the stand A is made of cast iron, well ribbed, about 22 inches in diameter, while the three legs are made of steel bars about ½ x 2 inches, well braced, as shown by bars C. The front, opposing brace is omitted in this illustration. Through the center of

this stand is a screw D, about 20 inches long, and not less than 1 inch in diameter. This is tapped through the bottom to a very loose fit so it may easily be run up and down by hand. A small hand wheel, E, may be fastened to the lower end of the screw, but it is of little use if the screw is sufficiently loose.

The top of the table is faced-off on the lathe, and at the same time, concentric circles are cut with a diamond point tool of sufficient depth to make a plain mark, separated ¼ or ⅜-inch. The diameters of these circles are stamped upon the plate, and they are used as an aid in setting the segments. Four cover plates, F, also faced, well ribbed to withstand the pressure, are required, one 20 inches in diameter, one 16 inches in diameter and two, 12 inches and 8 inches in diameter, respectively. In using the press, unless the job is small, it is advisable for two men to do the work, one to "slop glue" as a bookbinder would say, and the other to place the segments. Before beginning the gluing operations the segments should all be cut to the proper length so that it will not be necessary to stop to fit the last one of each course.

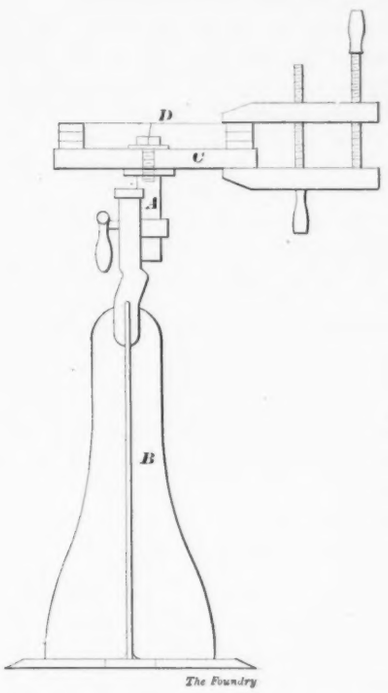


FIG. 1—TRIPOD GLUING STAND FOR SMALL SEGMENT WORK

Gluing the Work.

A convenient way of doing this work is to cut all the segments except one for each course to the exact length. Then "dog" one trial course around and find the length of the last piece, and the last pieces for all the courses will be cut the same length. Care should be exercised in the hurry of gluing to get one and one only last piece in each course. After the courses are all laid, a cover of the proper size is laid on the work and the nut is run down and slightly tightened. The work should then be examined and all open-end joints and overlapping segments which may have started to slide, should be tapped in place with a hammer. The press should then be tightened by means of the long double handle wrench, shown at G.

When using this press, all of the material should be run through the "pony" planer, which should be in good order so as to leave all the material of an exact equal thickness. It is impossible to get first class, end joints, such as are obtained by the use of "dogs" with this press. However, this is of no practical importance except for convenience in inside turning. It is also necessary to leave slightly more roughing stock, as the work laid up too hurriedly may run out of true more than material carefully glued.

However, this stand provides an equal pressure all around, making good, glued joints, eliminates the use of hand screws and is very rapid, as two men can glue a 12 x 12-inch ring in less than five minutes. Hot glue, not too thick, should be used, and the pressure should be applied before the glue on the bottom course chills. In case there are too many courses for one operation, two or more rings may be separately made and glued together in this press. It is for this purpose that the screw is made of this length.

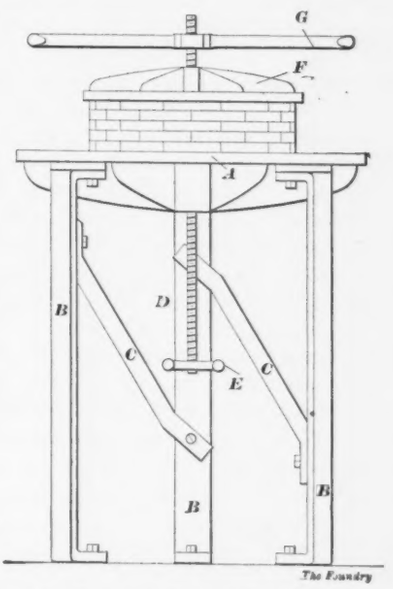


FIG. 2—GLUING PRESS REQUIRING NO HAND SCREWS

The screw fits loosely so that it may easily be adjusted to each job before beginning the gluing operation, and no time is wasted in running down the top nut. The press, shown in Fig. 2, has been in use more than a year and has proved very convenient and profitable, especially on medium and cheaper grades of work.

THE PRODUCTION OF STEAM CYLINDER CASTINGS

By HERBERT M. RAMP

THE STEAM engine cylinder has always been regarded as one of the supreme trials of the foundryman's skill and likewise has occupied a place high in the traditions and history of the business. The young molder feels he has reached the apex of his attainments when he is given the responsibility of molding cylinders, while the experienced molder feels a source of satisfaction when they are reported through the machine shop, and test as sound and perfect. There are many castings that are more difficult to produce, but none that have the widespread reputation for the exaction of the molder's skill, or are produced in such a variety of quantity. The service they are put to, the wear they receive, the necessity for absolute cleanliness, their intricate and complicated cores, make them a work of art when produced perfectly; there are so many things that can destroy their utility and efficiency, and, in short, they represent a grade of castings that

must be perfect in all details of workmanship and material.

The Sand.

The sand they are molded in must be right; it matters not whether they are made in green sand or dry, the sand must be open enough in either case. It is just as easy to have a dry sand mold to close and cause the iron to boil and collect dirt spots as it is to have a green sand mold cut and scab; but with this added disadvantage, a green sand mold shows the effects on the surface of the castings more plainly when the sand is close enough to cause the iron to boil and fret, than it does on one made in dry sand. If the sand is too close something must be used to make it open. Sharp sand is nearly always available, or a grade of heavy open sand; even fine gravel or pulverized stone, if the others cannot be obtained, but the sand mixture must be open. It will require more care in molding, more nails and gaggers, more attention to solid, firm ramming, but it must be open enough to permit the easy escape of the gases, or one cannot hope to produce either a smooth or a clean casting.

All of the dirt so often found in the boxes of cylinders does not enter the gates in the form of slag, or results from careless molding. It is fully as frequently caused by the sand being too close, and the iron not laying quietly in the mold when poured. This agitation of the iron causes the formation of a scum or dirt, that will puzzle the expert to distinguish it from slag. Too much importance cannot be attached to this, and the remedy lies in the hands of every foundryman, for in some manner he can doctor his sand until it is open enough. What is said of the sand for the molds is also true of the cores. They require the same material and the same treatment, so far as the quality of sand used is concerned.

Flasks and Patterns.

In regard to flasks and patterns, there is less to say. Nearly every foundryman has his own ideas, and the variety of design and local conditions make it difficult to suggest what is best. It is also true that poor equipment can be used and good castings produced, but at an added expense and a greater percentage of risk. Besides, today we have more good work than we have good molders. If the equipment is poor, if the flasks are weak or broken, if the patterns are makeshifts and require constant changes and stopping-off as well as the building-on of parts or flanges, the risk is increased, the cost of the casting is greater than it should be, and better mechanics are required to produce them. Good substantial flasks, good patterns and equipment go a long ways as an aid to produce good cylinder castings, and this is especially true when the quota of good molders is limited. If the molders are not competent to produce the grade of castings required, simplify the work so it becomes easy. Arrange the facilities to suit the capacity of the workmen. It is easier and less expensive than the education of men to the use of inferior appliances. Make the equipment so simple that the intricate casting becomes easy.

In this connection it should be stated that it pays to make cylinders in dry sand. It is true there is some question regarding the smaller sizes, but the reduction in loss, both in the foundry and the machine shop, and the better finish of the casting, makes it a money saving project in the end. The cost of a dry sand mold should be very little greater than that of one made in green sand. The extra expense would include the fuel for drying and the use of an iron flask.

Blacking for Cylinder Molds.

The blackings used on a dry sand cylinder and its cores are often responsible for dirt in the casting. A blacking that is applied wet should, when dried, be hard and firm, and should be able to withstand a vigorous rubbing with the hand without developing dust or a disposition to rub off, and should never come off under the application of the soft brush. If it does there are several remedies. One is to mix the blacking with clay wash; another is to go over the finished blacking with a camel hair brush and molasses water, and the third, which the writer has found of the greatest service is to mix from 10 to 20 per cent of talc or soapstone with the blacking. In the case of very poor blacking and the qualities of some sands, it may be necessary to use two or three of these remedies, but usually the talc is all that is required. The cores should be blacked and treated in the same manner as the mold as they are a part of it and there is little use to make a good mold and poorly blacked cores. Always use enough blacking, the most expensive is cheap on the individual casting, and it protects the surface of the mold and the cores. Some molders put on enough but have acquired the habit of slicking it all off with their tools instead of working it down to a uniform and substantial surface.

There has been a great difference of opinion as to the best way to pour a steam cylinder. Some cling to the old method of casting on end with a riser the full size and thickness of the cylinder wall extending an indeterminate number of inches above the flange, to receive all the dirt, which is afterward machined off. Some have gates on the flanges and others resort to the use of pop gates on top. But the most reliable and the most logical method is to use a core or draw gate as near to the bottom of the mold as possible, with the cylinder cast on the side, so that any dirt that may enter will lodge under the exhaust or port cores, where it can do little if any harm, and gradually fill the mold without wear and tear on the cores or surface of the same. It also reduces the tendency to shrinkage or spongy spots in or about the bore of the cylinder. While it is not necessary to cast on end, it is true that much dirt will arise in the head when this method is used, but it is possible and practical to cast them on the side when the workmanship and material are right.

Cylinder Cores.

The cores of a steam cylinder are frequently considered the supreme test of the coremaker's skill, and often he is responsible for dirty cylinders that are unjustly attributed to the molder. If the vents are not free and sufficient in number, if the sand is too close or too much binder is used, there will be an agitation produced in the mold that may not amount to a blow, yet it will be of sufficient violence to cause the accumulation of dirt that will spoil the casting. The sand must be open, no matter what binder is used, but if the cores are made with flour, they will require a more open sand than if made with linseed oil or some of the core compounds. In any event, the foreman is not justified in laying the blame of a dirty cylinder to the molder until he investigates the cores. In addition to the vents being free and open, the molder should look well that they receive a free passage to the air. When wax strings are used, beware of paraffine. It softens and rots the sand next to the strings when it melts and soaks in, and has often been the cause of the iron breaking through into the vents in the port cores, or other places where the wax vents come close to the surface of the core. Use good beeswax or some prepared wax that is known to be free from this weakness. Wherever it is possible, iron forms should be made on which the port

cores are dried. They dry more rapidly and retain their form, relieving the necessity for filing and fitting, and the destruction of the finished surfaces.

Use as few chaplets as possible in the castings. Fasten every core possible with bolts from the prints of the cores. Don't use wire. It is dangerous, and a drop of melted iron will cut it in half.

The Iron Mixture.

Up to this point we have simply referred to workmanship and the tools and supplies used in production, but equally great is the question of the iron to be used. It is as essential that the mixture be correct as any other detail. The ideal cylinder will show a fine, clear, uniform grain, free from spongy or soft spots, and as hard as it can be satisfactorily machined. A cylinder that is too soft wears out of round quickly and the engine loses its efficiency. But, worse than this is the casting that has soft spots or hard spots, or open, spongy places in the bore, such as often occur at the junction of two sections where the metal is heavier and retains its heat longer than other parts of the casting. This is the cause of much disastrous wear and cutting, and is more detrimental than a soft cylinder. These spongy places, or shrinkage spots, are sometimes remedied by the use of chills in the corners, or next to the intersections where the shrinkage occurs. Sometimes they are placed in the core that forms the bore, and while this will close up the spongy places, the practice is not good, as it causes the iron under the chill to be of a different degree of hardness, which brings us back to a casting that does not wear uniformly with its indisputable results. The correct mixture of the proper irons will overcome these spongy, shrinkage spots without the use of chills, and will also give a fine, strong iron. If the cylinders are in average section, 1¼ inches or under, the following analysis will give a close, clean and solid casting:

Silicon, 1.60 to 1.80 per cent; sulphur, under 0.10 per cent; phosphorus, 0.90 to 1.00 per cent; manganese, 0.50 to 0.80 per cent. If they run heavier, the silicon can be reduced as low as 1.00 per cent and the manganese increased to 1.00 per cent, according to section. Light cylinders for automobiles or gas engines can be made from the first mixture and beautiful castings produced. To make this mixture so it will possess the required qualities, a great deal more than the mere fact of conforming to the chemical analysis must be observed.

First.—The character of the pig iron must be known, its physical qualities or working qualities are as much value to the foundry as all the chemical determinations possible, for there are physical characteristics in pig iron, we call them physical because chemistry has not as yet revealed them, that cause two irons from different furnaces, but of practically the same analysis to act and work entirely different. There are certain furnaces, both in the north and south, that produce iron, the natural composition of which is to be hot short, develops shrinkage holes and spongy spots where two sections of unequal area join, or where heavy ribs or bosses occur. The analysis of this iron may, however, prove it to be satisfactory for the purpose intended. When the trouble in this direction is pronounced, change the brand of pig iron used, for it is possible and probable that some of the difficulties of this character date back to the ore used to make the iron, and cannot be corrected by any known method.

Use of Scrap.

Second.—Use a small percentage of scrap steel in the mixture in the first mixture, 5 to 10 per cent, and in the second, 10 to 15 per cent. This is required for two reasons; it breaks up the graphitic carbon into a finer grain or flakes, which makes the casting closer grained and stronger with little increase in hardness, and second because it counteracts the influence of the high phosphorus which has a tendency to make the iron weak or erratic. The amount of steel scrap used does not affect the amount of carbon present in the iron to any extent, as the iron takes up from the fuel, in every case, the amount of carbon that has been reduced in the total mixture by the use of steel scrap. For example, if an iron containing 3.50 per cent of total carbon is melted with an equal portion of steel containing 0.50 per cent carbon, theoretically the resultant mixture would contain about 2.00 per cent carbon. But such is not the case. The melted iron takes up carbon from the fuel until it contains almost as much as the original pig iron. The introduction of steel with cast iron into the cupola converts it back into cast iron, but with this difference. The graphitic carbon is broken up into finer flakes, or exists in a different chemical combination.

High Percentage of Phosphorus.

No doubt, some criticism will be made of the amount of phosphorus advised, but it is also true that phosphorus is the most abused of any of the elements in cast iron. There is a deep seated prejudice that it makes iron weak and erratic under any circumstances, but such is not the case. It is true that a moderately high silicon iron will be weakened by its use, but with the silicon kept to the limits given, and steel scrap used as directed, an iron of as uniform strength and quality can be produced as from a lower phosphorus iron. When kept within the limit of 1.00 per cent, it has a softening effect as well as closing up the grain in a remarkable manner, and coupled with the small percentage of steel it gives that close, fine, uniform polish to the iron so much to be desired in cylinder castings. Again, it is the element that does more than all the rest to eliminate the spongy or open spots in the finished castings. It, and a fairly low silicon, are the remedies, so far as analysis is concerned, to cure this disease. One of the reasons for this is that it retains the metal in a liquid state at a low temperature, and careful experiments will prove that it is the most powerful factor, properly handled, to make the grain of the iron fine and uniform, and to cure the spongy spots in heavy sections.

This has been written to treat the question in its broadest sense, not from the standpoint of any particular kind, size or style of cylinder, but in the hope that it may be a general help to those engaged in the manufacture of these castings.

THREE METHODS OF MOLDING PUMP PLUNGERS

By J. TEMPLE McCARTNEY

ONE of the problems that confront makers of mine pumping machinery, especially those who manufacture pumps for the anthracite mines of Pennsylvania, is the art of successfully casting pump plungers to withstand the corrosive action of the intense sulphur or acid water of the mines, and incidentally to reduce friction and wear on the casting to the minimum.

The cost of replacing pump castings in the deep mines is an expensive undertaking, sometimes entailing a complete shutdown of the operations. The cost of the casting in itself, being insignificant in comparison with the

closing of a mine employing 400 or 500 men, and a consequent curtailment of output. Hence it is obvious that castings of this character should at least be nearly perfect.

A brief resume of the methods employed at the Drifton shops of the Lehigh Valley Coal Co., Drifton, Pa., under the management of Wm. Lloyd, a gentleman of wide experience in the manufacture of mining machinery, may be of interest to the craft. It may be stated that these shops make castings only for their own collieries, no outside work being done. Every casting is rigidly inspected before shipment, no mediocre work can possibly slip through.

Methods Employed.

Three methods are employed in molding these castings: Fig. 1 illustrates the plan and details of molding and pouring plungers from 10 inches to 24 inches in diameter; Fig. 2, details for molding plungers from 5 inches to 9 inches in diameter; Fig. 3, details for molding plungers from 2 inches to 4 inches in diameter.

Practical men will readily see the advantages contained in these methods. The cores being suspended in the mold obviates the use of studs and chaplets, precluding the possibility of those small blow-holes that shorten the life of so many otherwise perfect castings.

The stroke or length of the plunger should be taken into consideration in using either of these methods. Almost any length plunger may be made with the appliances shown in Fig. 1. With the rigging in Fig. 2, any length within a 36-inch stroke can be made. Fig. 3 serves for any length within 24 inches.

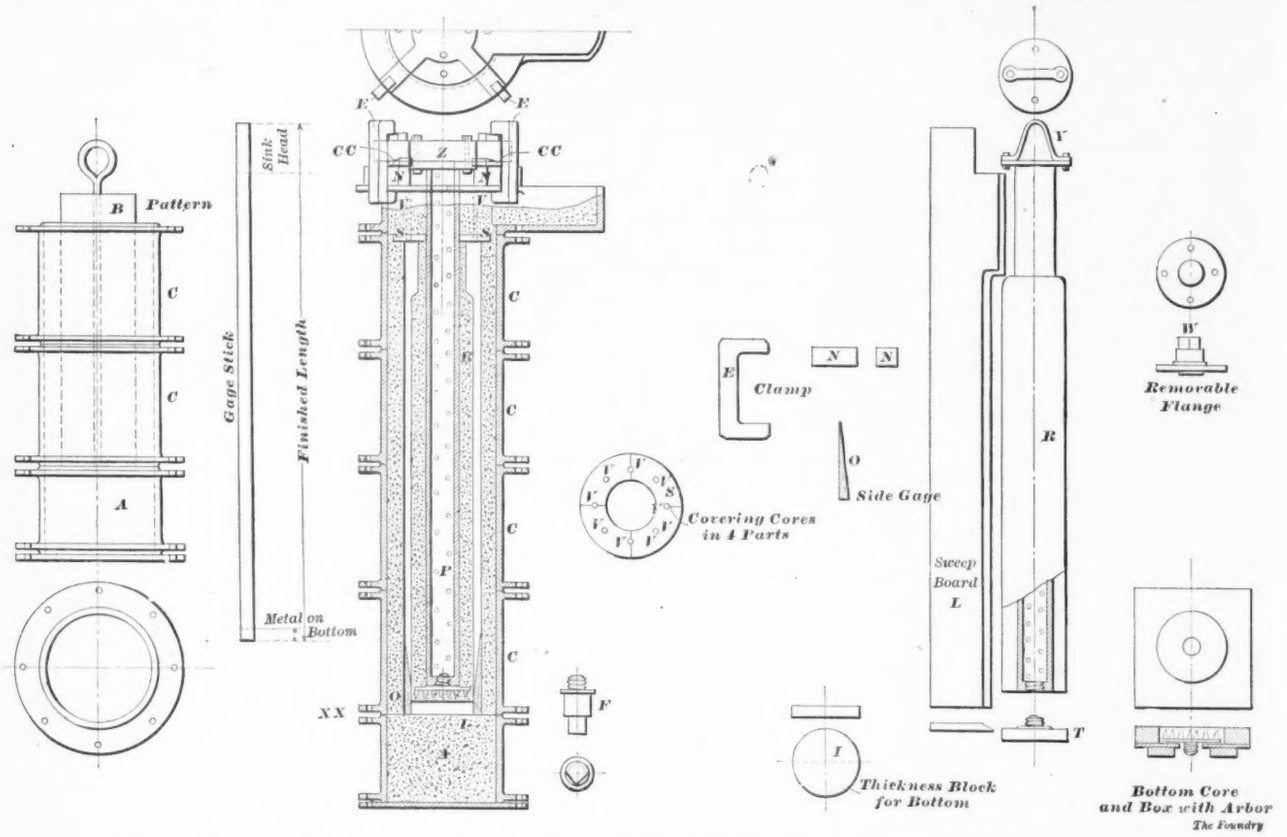


FIG. 1—EQUIPMENT FOR MOLDING AND CASTING PUMP PLUNGERS FROM 10 TO 24 INCHES IN DIAMETER

Figs. 1 and 2 are made in dry sand and in every instance the mold is poured on end. The operation of molding these plungers is extremely simple. It is a truism that there is no absolute certainty in the production of castings, yet plungers made in this manner border very closely this condition.

The pattern charges are considerably reduced; a full pattern not being required. A part of pattern B, the right diameter, say at least 3 feet long, is procured and placed on the bottom section of flask A which has been previously bricked in and swept up in loam, as it is on this bottom the iron must fall from the top of the mold. Then sections of flask C are placed in position and rammed, this being continued and the pattern drawn up at intervals until the proper length is reached. This is ascertained by a gage stick secured from the patternmaker showing the length, thickness of metal on the bottom, and allowance made for the sink-head, which is usually about 4 inches.

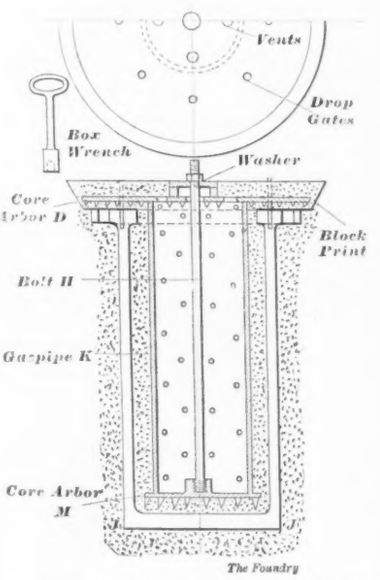


FIG. 2—SECTION OF MOLD FOR PUMP PLUNGERS FROM 5 TO 9 INCHES IN DIAMETER

The flasks being made in sections, 12 inches deep, in diameters to suit the castings being made, may be jointed every 24 inches to facilitate blacking the mold, and are all interchangeable, the two pin holes in each flange being drilled to template, the six bolt holes being cored in.

Cores.

The cores required are the main core R, which is a loam core swept up with

sweep L on core barrel P, as shown in Fig. 1, covering cores S, which are made in quarter sections with gate holes V, through which the mold is poured.

In preparing to cast the plunger, the bottom piece A and section 1 of the mold are put together, thickness block I is placed in position and four gage sticks O placed around it. The mold is then assembled in the order in which it was rammed and every joint bolted except that at X X. The mold is then ready for the core.

The flange journal W which was used for revolving core R in sweeping it up is now removed, and bail Y bolted in position on the flange of the core barrel L, preparatory to hoisting core R on end. When up-ended, removable journal F is taken out and bottom core T is screwed into the core barrel. The intersection is filled in, blackened over and dried with a torch or a few wood shavings, then lowered into the mold where it is readily centered by the aid of tapered gage sticks O, previously placed in position in the bottom of the mold, as shown in the cross section Fig. 1.

Setting the Main Core.

Care should be exercised in centering the main core at the top of the mold, then placing covering cores S in position which should snugly fit the neck of the core R, which aids in retaining the core central; bail Y is removed, gate sticks placed and the pouring basin built. The 4-way cross Z, is placed on the flange of the core barrel and is bolted firmly in position with blocks N and wedges CC. The mold and core are hoisted clear of joint XX, thickness block I and gage sticks O are removed with any sand that may have fallen through by reason of building the pouring basin. The main core R is tried with a pair of calipers and if not exactly central a slight tap on wedges CC, under cross Z, will tilt the core in any desired direction. The mold is then lowered in position and joint XX, bolted. Clamps E are placed on cross Z and firmly wedged on the flange of flask C to prevent core R from moving.

The Metal.

It is essential that hot iron be used and the pouring basin should be kept full from the start. About 10 minutes after pouring, clamps EE should be loosened to permit the expansion of the core barrel, thereby preventing the straining of the casting.

The molding of the pattern in Fig. 2 is somewhat similar, the same flasks being used, none of the flask sections, however, being jointed, except on the bottom at JJ. A full pattern is required as it is usually a standard job that is made by this method, as well as the plug shown in Fig. 3. The particular and essential features pertain to the construction of the core which requires a full box. The core arbor can be designed and made at a very slight expenditure in consideration of the results obtained by its use, and consists of bottom arbor M, which is tapped for bolt H, which is threaded on both ends. A piece of gas pipe K is drilled at intervals 6 inches or 8 inches apart

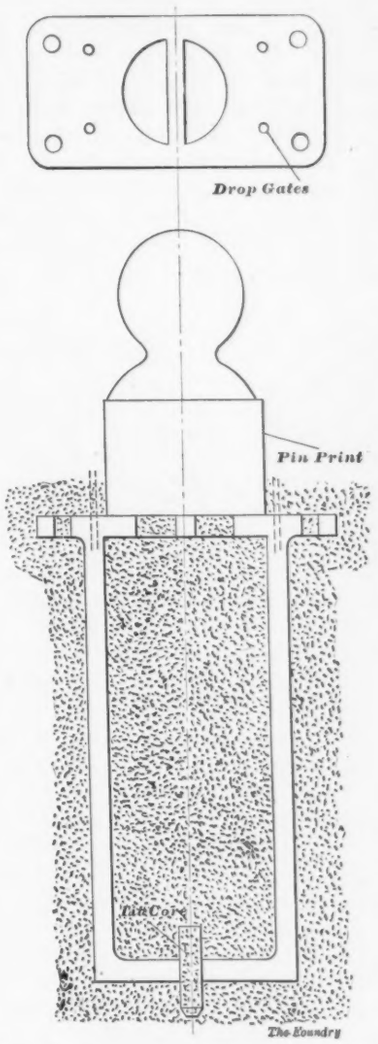


FIG. 3—EQUIPMENT FOR PUMP PLUNGERS FROM 2 TO 4 INCHES IN DIAMETER

with ½-inch holes, and top arbor D with the necessary holes cored in for vents and gates, as shown in the plan, Fig. 3.

Core Box.

The core box is placed on a plate or board with sufficient sand to rap bottom arbor M down to a firm bearing; bolt H is screwed in and the pipe K is placed on top of arbor M. The pipe should be of a diameter to give at least 2 inches of sand on each side. A few wooden plugs driven in the holes of the pipe will assist materially in supporting the weight of sand. The pipe may be filled up with cinder and the core rammed in the usual way, using the vent wire occasionally on the outside of the pipe. The top arbor is then placed in position resting on pipe K, gates and vents are placed to connect with the cinders in the pipe and the ramming is continued. When blocks and washers are put in the whole is screwed firmly together making a rigid arbor and a solid core. About 2 inches of the bolt should project above the top of the core to enable the use of a box wrench by which to hoist up the core when preparing to cast the mold. This rigging can be used an indefinite number of times providing bottom arbor M is made of a size to pass through the neck of the plunger. This construction gives great rigidity, insuring exact alignment and the elimination of chaplets. The tapered block print, shown in Fig. 2, allows the core to be lowered into the mold and to find its own center. The core being firmly wedged on top of the block print, the pouring basin built, the mold and core combined may be lifted from joint J J, examined, and any particles of sand removed.

Another Method.

The method shown in Fig. 3 is almost self-explanatory, consisting merely of a straight core with a pin print for the cope and a small taper print on the bottom with a tit core inserted in the main core, which determines the center, and holds the main core in position while pouring.

MIXTURES FOR HEAVY MILL BRASSES.

Question:—Will you kindly give us a good mixture for heavy mill brasses? Would a mixture containing 5 per cent manganese copper and 95 per cent of lake copper be suitable for blast furnace tuyeres? What other alloy would be good for this work?

Answer:—A good mixture for heavy mill brasses follows: Copper, 80 pounds; lead, 10 pounds; tin, 8 pounds; phosphor tin, 2 pounds. A mixture of 95 per cent lake copper and 5 per cent manganese copper is not suitable for blast furnace tuyeres as the castings will be full of "cold shuts" unless aluminum is also used. A mixture of 98 per cent copper, not necessarily lake, and 2 per cent silicon copper, will be found to give good results. Another very easy casting alloy contains 95 per cent copper and 5 per cent zinc. K. K.

EFFECT OF PERMANENT MOLDS ON IRON*

A discussion of the peculiar properties imparted to cast iron by the use of permanent molds

By EDGAR ALLEN CUSTER

IN looking over the work done by this and kindred scientific societies, one cannot fail to be impressed with the wonderful advancement that has been made in the knowledge their close scientific research has given us, as well as with the logical means they have pointed out in order that this knowledge may bear practical fruit. Day by day the patient, painstaking work is carried on and unselfishly given to the world at large. It is perhaps natural that the major part of these researches are directed toward steel. The ramifications of this metal are extending, and

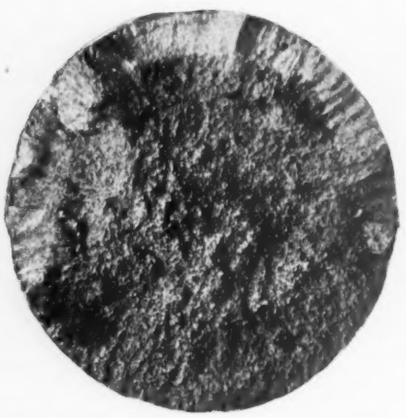


FIG. 1—FRACTURE OF PARTIALLY CHILLED CAST IRON

it is small wonder, in view of what has been accomplished, that the attention of scientific thinkers and investigators has been largely turned to its study. It is at this stage the writer comes forward with a plea for the humble cast iron.

The work noted in this paper covers a limited field, but enough has been learned to give rise to the thought that in this crude material there lurk potentialities which, when scientifically investigated, may not only enlarge this field, but put an entirely different phase on our understanding of cast iron.

Some four years ago, under the stimulus of a disastrous strike, we started on the hunt for the permanent mold, and finally selected cast iron as the material offering the greater number of advantages and the least number of objections. In the course of our investigations it was noticed that certain of the castings when cool were soft while others were hard—in fact, chilled white—the hard castings being in an overwhelming majority. As a remedy we tried various mold coatings of inert materials, but we found that while certain of these coatings gave very good results when applied thickly, yet they slowed up the process. In an effort to gain time the coating was neglected, and it was ascertained that when working at good speed, the major portion of the castings were soft and could be easily machined. When the coating was entirely discarded and the castings poured and removed from the mold as soon as they had solidified sufficiently to handle, the total production was soft and no hard castings were produced. After some 14,000 or 15,000 castings had been made under every condition that could be obtained in an ordinary foundry, the following bases were established:

(1). Molten cast iron does not chill (using the word "chill" to express hard, white crystals) until after it has solidified.

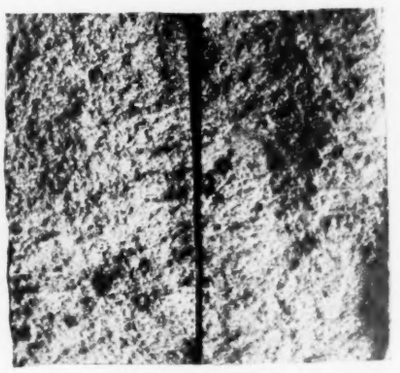
(2). Chilling molten iron swiftly to the point of solidification, and then allowing it to cool normally, produces a homogeneous metal.

(3). This homogeneous metal possesses certain characteristics that are entirely absent when the same molten iron is poured in sand and allowed to cool in the mold.

(4). The chemical constituents of the iron, with the exception of carbon, have little or no effect in modifying these characteristics, when gray iron, within ordinary limits, is used.

Inasmuch as all work we have done has been in sections ranging from 2 inches to ⅛ of an inch, it is obvious that the results obtained must be considered in direct comparison with those obtained when these same sections are cast in sand. The casting so low in silicon that it will form white crystals when made in sand, will inevitably form the same white crystals if cast in a permanent mold, even though treated by the process outlined above. This applies principally to thin sections; how far this process can affect thick sections depends entirely upon the ability of the investigator to rob the molten mass of its heat.

In support of the first two propositions it may be said that molten cast iron is a solution of carbon in iron, with the addition of silicon, phosphorus, sulphur, manganese and certain impurities—all forming a homogeneous, fluid mass. Now, if this mass can be instantly cooled it will still be homogeneous, the different elements not having time to segregate. Instant cooling is clearly impossible, but we find that



FIGS. 2 AND 3—FRACTURES OF SOFT AND HARD CAST IRON

swiftly chilling the molten mass produces practically the result desired. The molecular action of forming white, hard crystals is only started. When the casting is removed at a bright, yellow heat, with the interior still molten, this molecular action—which is nothing more nor less than a continued closing together of the particles—compresses the molten iron to such an extent that globules of iron exude through the pores and form small excrescences on the surface.

Since the cooling medium, in other words, the iron mold, is removed at the point of solidification, there is no further tendency toward forming larger crystals; furthermore, segregation is completely prevented by reason of the rapidity with which this chilling action

*Presented before the American Society for Testing Materials.

is performed. We have tried to reproduce this effect in sand molds, but with no success.

Fig. 1 shows a broken section of a casting one side of which was retained in the mold long enough to produce the white crystals; the other side is soft gray iron.

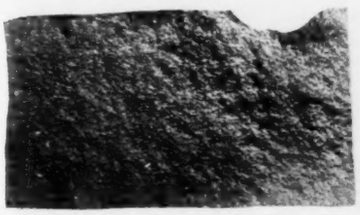


FIG. 4—FRACTURE OF HIGH-SILICON LOW-SULPHUR CAST IRON—HARD

FIG. 5—FRACTURE OF LOW-SILICON HIGH-PHOSPHORUS CAST IRON —HARD

Fig. 2 is a section from another casting, which was taken from the mold when the point of solidification was reached and was allowed to cool normally.

Fig. 3 shows a section of the same casting taken from the mold at a bright red and quenched in water.

Figs. 1, 2 and 3 were poured from the same ladle of iron. The analysis of this iron was: Silicon, 2.12; sulphur, 0.098; phosphorus, 0.70; manganese, 0.38; total carbon, 3.49.

No. 1 is useless as a casting, showing white crystals on one side and dark gray on the other.

No. 2 is clean, soft, easily machined and is as nearly homogeneous as can be shown by any test we can devise. It has a dark gray fracture, machines cleanly, the chips being free from fine dust, and does not show the usual hard scale on the exterior. When heated to a bright red or yellow heat and quenched in cold water it has a very light gray fracture and is as hard as tempered tool steel. When used as a cutting tool it will outlast any ordinary high-carbon steel. Bring it in contact with a working dynamo after hardening, it becomes a permanent magnet. It does not possess the disadvantage of increasing in bulk when repeatedly heated and cooled. If Fig. 2 be held in a bright flame until metal drips from the end, the remaining iron will be unchanged in every particular, with the exception of a slight coating of oxide.

Fig. 3 shows a light gray fracture, and is an exact duplicate of No. 2, hardened. When heated to the temperature at which it was hardened and allowed to cool normally, it reverts to the characteristics of Fig. 2. This heat need not be long continued; the mere heating to the proper temperature is sufficient to accomplish the result.

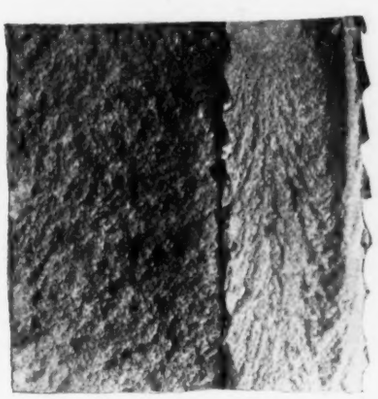


FIG. 6—FRACTURE OF FILE AND OF HARDENED CAST IRON

FIG. 7—FRACTURE OF ORDINARY CAST IRON

Figs. 4 and 5 are from the same mold. Their analyses follow:

No. 4.		No. 5.	
Silicon	2.94	Silicon	1.75
Sulphur	0.032	Sulphur	0.07
Phosphorus	0.028	Phosphorus	1.42
Manganese	0.38	Manganese	0.41
Total carbon	3.08	Total carbon	3.22

These present precisely the same phenomena as Figs. 2 and 3, so far as any tests applied will show.

It would seem, from the analyses of the treated samples, that the peculiar properties observed are entirely independent of whether the silicon, sulphur or phosphorus is high or low, at least within the limits noted. It is immaterial whether the silicon is 1.75 or 3 per cent, the sulphur 0.02 or 0.12 per cent, or the phosphorus 1.50 or 0.03 per cent; in any event the same practical result is obtained if the procedure outlined is correctly carried out. In no respect have we been able to duplicate these results when the same iron was poured into sand molds of like dimensions.

The logical explanation of this hardening property is that the molecular action, which produces a homogeneous metal by chilling molten iron to the point of solidification, is again the medium of producing the extreme hardness. The first chilling brings the molecules to what might be termed a receptive position. Removing the chilling medium holds this position, and as the temperature falls the molecular position becomes permanent. If at the receptive point the casting be quenched in cold water, the great unmeasurable force of heat expansion and contraction is brought into play. No one knows how many tons per square inch is exerted when molten iron cools. This force is always greater than the tensile strength of the material under treatment. If, now, the semi-solid iron be subjected to this presumably enormous force exerted through the mold, swiftly robbing it of its heat, it probably follows that the molecules are crushed

FIG. 8—MAGNIFIED 104 DIAMETERS

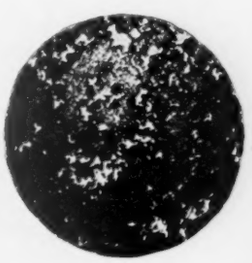


FIG. 9—MAGNIFIED 30 DIAMETERS

FIG. 10—MAGNIFIED 30 DIAMETERS (OBLIQUE LIGHT)

IRON CAST IN PERMANENT MOLD (SOFT. SAME AS FIG. 2.)

together with an enormous pressure, and an extremely dense structure results. If the casting be quenched in oil, there is no hardening effect; it remains soft. If thrown into boiling water, it cracks into pieces.

Fig. 6 is the fracture of an ordinary

FIG. 11—MAGNIFIED 104 DIAMETERS

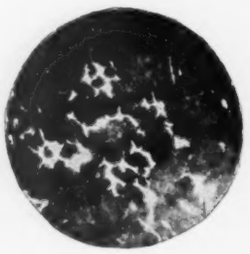


FIG. 12—MAGNIFIED 104 DIAMETERS

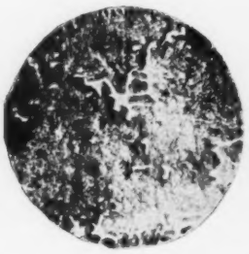


FIG. 13—MAGNIFIED 104 DIAMETERS

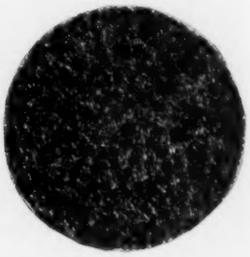


FIG. 14—MAGNIFIED 30 DIAMETERS (OBLIQUE LIGHT)

IRON CAST IN PERMANENT MOLD (HARD. SAME AS FIG. 3.)

forged and hardened steel file placed alongside of hardened cast iron, shown in Fig. 3. The analyses follow:

File.		Cast iron.	
Silicon	0.19	Silicon	2.12
Sulphur	0.022	Sulphur	0.098
Phosphorus	0.019	Phosphorus	0.70
Manganese	0.25	Manganese	0.38
Total carbon	1.28	Total carbon	3.49

This photograph shows very clearly the coarse grain of the cast iron and the metal flow of the steel file, yet the cast iron is the harder metal.

Fig. 7 gives a very good idea of the difference between casting in sand and in a permanent mold. This fracture is of the same iron that was used for

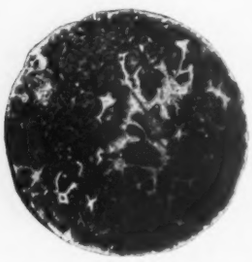


FIG. 15—MAGNIFIED 104 DIAMETERS IRON CAST IN PERMANENT MOLD (HARD, SAME AS FIG. 4)

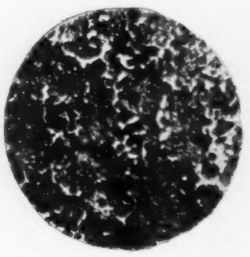


FIG. 16—MAGNIFIED 104 DIAMETERS

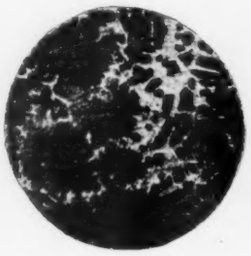


FIG. 17—MAGNIFIED 104 DIAMETERS

FIG. 18—MAGNIFIED 104 DIAMETERS

IRON CAST IN PERMANENT MOLD (HARD. SAME AS FIG. 5.)

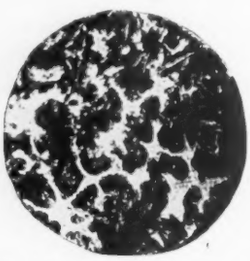


FIG. 19—MAGNIFIED 104 DIAMETERS SAME IRON AS NO. 2, BUT CAST IN SAND (SEE FIG. 7)

The fracture photographs are given a magnification of 2½ diameters.

A mold for making plowpoints, as well as its core, is shown in Fig. 21. We have been able to make four plowpoints a minute in this one mold and each casting has been perfect in structure.

Fig. 22 is somewhat of a curiosity as it is a permanent mold for making claw hammers. The core arbor at the side is one of the peculiar features of this mold. It makes the slot between the claws and the opening for the hammer handle in one motion. We are able to cast about four of these per minute.

A mold for an odd-shaped casting, persumably a trap of some kind, is illustrated in Fig. 23. It offers peculiar difficulties for a permanent mold, in that the rim is less than ¼-inch thick while the main body of the casting is over 1 inch in section; and in order to make this casting successfully, so that it is not chilled, it is necessary to make the arbor and plug in such a manner that it can be withdrawn quickly at one portion and slowly at another. We are able to make one of these castings every 30 seconds.

In this work carbon plays a large part, although it does not seem to have the same effect as when iron is cast in sand. A few notes on this phase may be interesting. Since all the carbon in molten iron is in solution, and exists in the combined form, then, if molten iron be instantly cooled to 1,000 degrees Fahr., all the carbon will be held in the combined form, there will be no free carbon. If, however, it be instantly cooled to the point at which the iron sets, and then allowed to cool normally, the carbon will be in the combined form at the time of setting, but will change to the free form as the cooling progresses. This formation of free carbon is very rapid; the major portion present in the casting is formed within a few seconds after it is taken from the mold. The analyses below give a very fair

FIG. 20—MAGNIFIED 104 DIAMETERS FRAGMENT FROM LARGE CASTING

idea of this action, the pieces in question being 6 x 1¼ x ½ inches:

	Combined carbon, per cent.	Free carbon, per cent.	Silica, per cent.
Cast in sand and cooled normally	0.21	2.93	2.61
Taken from permanent mold at bright yellow and quenched..	1.50	1.52	2.61
Taken from permanent mold at bright red and quenched	0.49	2.61	2.61

that entitle it to a very large portion of the consideration that has hitherto been enjoyed by wrought iron and steel. One hardly dare say that the ultimate possibilities of this metal have been reached, nor can it be considered in the light of an unstable and refractory medium. On the contrary, it answers readily and surely to the proper treatment. The field is wide, and gives promise of much that would place cast iron on a far higher plane than it occupies today.

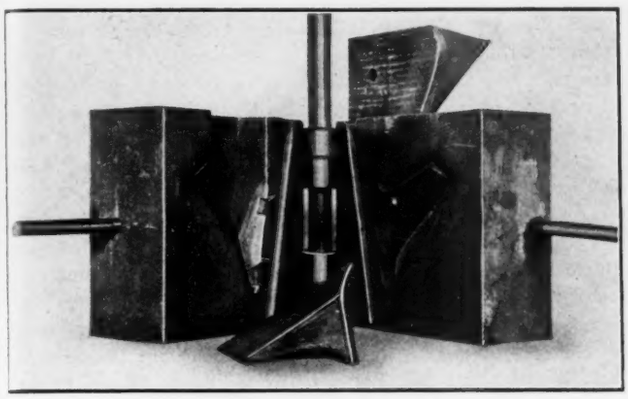


FIG. 21—PERMANENT MOLD FOR CASTING PLOWPOINTS

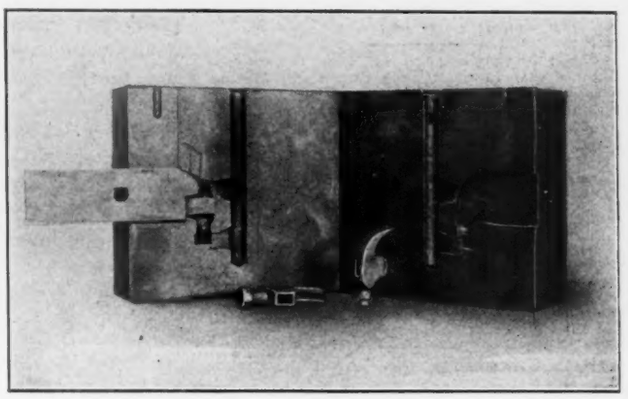


FIG. 22—PERMANENT MOLD FOR CASTING CLAW HAMMERS

It will be seen from this that two-thirds of the combined carbon has been changed in the few seconds required to cool from a bright yellow to the bright red. The free carbon in all these castings is not in the form of graphitic carbon, as we usually see it in ordinary cast iron, but partakes more of the character of annealing carbon, as exhibited in a malleable casting.

Here we have an iron containing 2.61 per cent silicon and 2.50 per cent free carbon that possesses the property of taking a temper equal to tool steel, and this without the least indication of what is generally termed "chill."

At this writing the tensile strength is under investigation. The scope of this research is very large, and many elements must be taken into consideration. Our results so far indicate that cast iron, when chilled in a permanent mold to the point of setting and then cooled normally, is greatly increased in tensile strength, and that this strength does not materially vary within the chemical range of ordinary foundry iron.

The thickness of the section and the initial heat of the casting have the most influence in determining the ultimate strength, and these variations call for an extended consideration.

Heretofore cast iron has had a rather poor reputation, being generally unstable and yielding reluctantly to any treatment that would tend to improve the quality. The permanent mold has done valuable service in demonstrating that the simplest of simple heat treatments endows it with characteristics

DIFFICULTIES EXPERIENCED IN CASTING ROPE WHEELS WITH WROUGHT IRON ARMS.

Question.—We have recently experienced considerable difficulty casting rope wheels which have wrought iron arms cast in the rim and hub. To cite a recent case, we filled an order for a wheel 8 feet in diameter, depth of groove 2½ inches, with 24 wrought iron arms 1⅛ inches in diameter. The ends of some of the arms were chalked, others were covered with red lead and paraffine, while the third lot was covered with red lead and turpentine. The first two wheels were scrapped, as they were spongy and full of blowholes in nearly all of the bosses around the rim, as well as in the hub. The third wheel, however, appeared to be sound. We make a large number of these wheels, but with varying success, and would like to know how to secure good castings.

Answer.—Considerable difficulty is generally experienced in attempting to cast gray iron against wrought iron. One large manufacturer of rope wheels tins both ends of the wrought iron arms, and difficulties from blowholes have thereby been almost entirely eliminated. Another foundry engaged in a similar line of work sand-blasts both ends of the arms and then coats these ends with black shellac, upon which borax is dusted before the shellac has had opportunity to dry. This method has proven satisfactory and the difficulties previously experienced at this plant have been almost entirely eliminated by the adoption of this process.

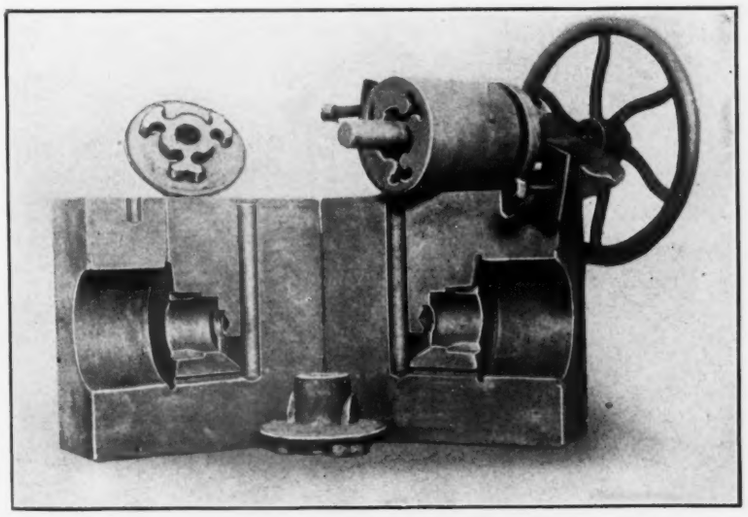


FIG. 23—PERMANENT MOLD FOR AN INTRICATE CASTING

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Trade Outlook

Continued activity in pig iron throughout the past 30 days reflects the steady improvement in the iron and steel trade, and while there is still considerable idle capacity in the foundry industry, nevertheless, orders are more plentiful and foundrymen generally are more hopeful of the future. The continued buying of cars by the railroads has resulted in the placing of a large tonnage with both malleable and steel foundry interests, and the concerns thus favored made heavy purchases of pig iron to cover not only their present, but future requirements as well. The leading agricultural interests have covered their needs well into the first half of next year, while several malleable founders contracted for a sufficient tonnage to carry them through the next 12 months. Prices have likewise advanced and in the Mahoning and Shenango Valleys, Bessemer iron is firmly established on the basis of $15.50 to $16.00, while basic is held at $15.00. In the Chicago district No. 2 foundry iron is quoted at $17.00 and No. 2, southern, is $15.75, Cincinnati. In the east, No. 2 standard is quoted at $16.50, Philadelphia and Lake Superior charcoal is selling at $19.50, Chicago. The organization of a large holding company which has already acquired control of a number of large motor car plants is of more than ordinary interest in view of the fact that it is the intention to make purchases of raw materials for all of these concerns from one central bureau. In addition, a combination of aluminum casting manufacturers is under way and it is probable that the options will shortly be taken up. To what extent the leading producer of aluminum is interested is not definitely known, but it is evident that this consolidation will furnish a large outlet for the aluminum made by this concern.

COST OF MAKING CAST STEEL.

To the Editor:

Inasmuch as it appears that some have been misled by my article, "The Cost of Steel Making in Foundries," published in THE FOUNDRY, in June, 1909, pages 176-8, we ask you to publish this statement, that the figures given there for "Cost of Steel and Castings" should not be taken to mean the total cost of the castings, but only so much of it as includes the charges for producing the metal. To these charges should be added those for molding, cleaning, chipping, cutting off heads and gates, annealing, general foundry expense, selling, taxes, insurance, freights, etc. It often happens that the cost of the steel in the castings is only a small part of the total cost of making these castings.

BRADLEY STOUGHTON.

IS SEMI-STEEL A MISNOMER?

To the Editor:

Twenty-five years ago, foundrymen generally agreed that there was no such metal as semi-steel. In the early days, castings made from steel mixtures were hard, filled with blow holes and resembled the defective crucible steel castings of that period. Many foundrymen still assert that there is no mixture which can be properly termed semi-steel. They claim that the two metals do not mix; that the steel does not unite with the iron and castings containing steel have many hard spots. Nevertheless, at the present time semi-steel castings, such as small cylinder heads, cylinders, piston rings, ammonia castings of comparatively light section, generator sections, etc., containing as high as 30 per cent of steel scrap, can be made in the foundry at a lower cost than many fancy iron mixtures. I have a letter in my possession dated February 1, 1904, from one of our most noted foundry metallurgists condemning the use of the term semi-steel. However, my method of producing this mixture was commended. Referring to my practice of using from 30 to 40 per cent of steel scrap in the mixture and quoting from his letter, this metallurgist said: "I can only, therefore, congratulate you on this work, and hope you may reap some good returns from it. Nevertheless, it seems a pity that others should be made to lose money all the time from the lack of this information." An eminent electrical engineer a few months later wrote as follows: "Regarding the use of semi-steel castings in direct-current generators and motors, would say that I have found it possible to work both in density and cross section just half way between steel and cast iron. In other words, a cast iron magnet frame that would require 100 square inches of metal would only require 75 of semi-steel and 50 of steel. It is particularly useful for machines in which the speed is from 10 to 20 per cent lower than that of standard types."

Heretofore the electrical engineer had only two metals, iron and steel, to consider. Now he has iron, steel and ———. In some cases there is as high as 50 per cent steel in the mixture. Would you call it semi-steel?

DAVID MCLAIN.

FOUNDRY & PATTERN SHOP EQUIPMENT

Electrically operated pattern shop equipment---Large brass furnace installation---Shrinkage rule---Ladle carrier---Saw tooth roof construction

THE use of electrical apparatus in pattern shops is rapidly gaining favor, and all of the woodworking tools installed in the new two-story plant recently built by the Mesta Machine Co., Pittsburg, are motor-driven. The building is of reinforced concrete construction and further protection against fire is afforded by the overhead sprinkler system on both floors. The roof construction is novel in that there are no supporting columns other than the side steel frame work. The machines are all driven by individual motors obviating the use of overhead belts, and the wiring is entirely concealed, making the general appearance of the shop particularly clean and attractive. It is equipped throughout with machinery suitable for the production of patterns required for the large engines and rolling mill machinery manufactured by this concern.

The general arrangement of the shop is shown in Figs. 1 and 2, Fig. 1 is a view of the shop with patterns of various descriptions in different stages of completion, while in Fig. 2 the shop has been cleared of work and the arrangement of the machines is clearly shown. The equipment includes three bench saws, three band saws, a swing saw, three surfacers, three jointers, three lathes, a planer and pattern scroll saw. Each machine is driven by its own motor, either belted, or in a few cases, as with the two speed lathes, direct-connected. The planer and the surfacers are driven by a countershaft to which the motor is direct-connected. The motor for the scroll pattern saw is directly coupled to the crank wheel, providing a most compact arrangement.

The capacities of the motors, and the machines to which they are connected, are given in full in the accompanying table. It is to be particularly noted that the motors are largely 3½ or 5 horsepower. This is due to the fact that it was desired to secure as many motors as possible of one size, in order to keep the repair parts carried in stock at a minimum. These 5-horsepower motors, running at 1,600 revolutions per minute, and the 3½-horsepower motors, running at 1,050 revolutions per minute, are built on the same frame, and all parts, except armatures and field windings, are interchangeable. Spare armatures and field coils of each type are kept in stock in readiness for any accident.

These motors are of the direct current 220-volt, shunt wound type. To prevent damage to the commutator by the accumulation of dust and dirt, the electrical superintendent, F. G. Galbraith, has devised a neat wire covering which affords ample ventilation and yet prevents the shavings,

FIG. 1—GENERAL VIEW OF THE SECOND FLOOR OF THE MESTA MACHINE CO.'S PATTERN SHOP

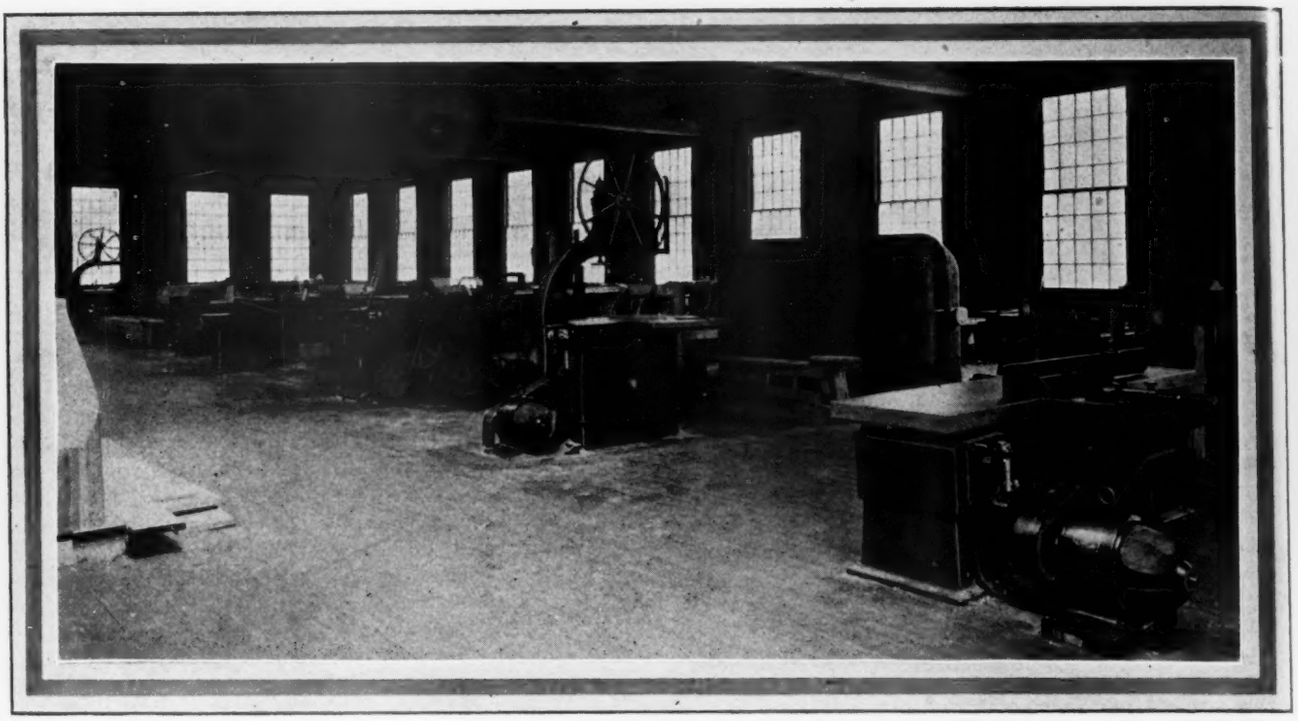


FIG. 2—ANOTHER VIEW OF THE PATTERN SHOP SHOWING THE FLOOR CLEARED OF WORK TO SHOW THE ARRANGEMENT OF THE WOOD-WORKING TOOLS

etc., from getting inside the motor.

Protection to the belts from dirt, etc., and to the operator in case of a broken belt, is afforded by a special steel guard which is fastened to the floor and to the motor frame, and completely encloses the belt.

The wiring is all carried in an 8-inch conduit in the floor, which runs the full length of the shop, with outlets at each machine. This conduit is packed with kiln-dried silica sand which absolutely prevents any possibility of arcing or fires. The switchboard is in a separate room where the saw filing and knife grinding are done by an automatic filing machine, which is so arranged that the band saws may be loosely looped over an old band saw wheel.

In addition, there are nine glue pots, electrically heated, where all the glue is warmed. Practically the entire motor equipment, together with the glue pots, was supplied by the Westinghouse Electric & Mfg. Co., Pittsburg.

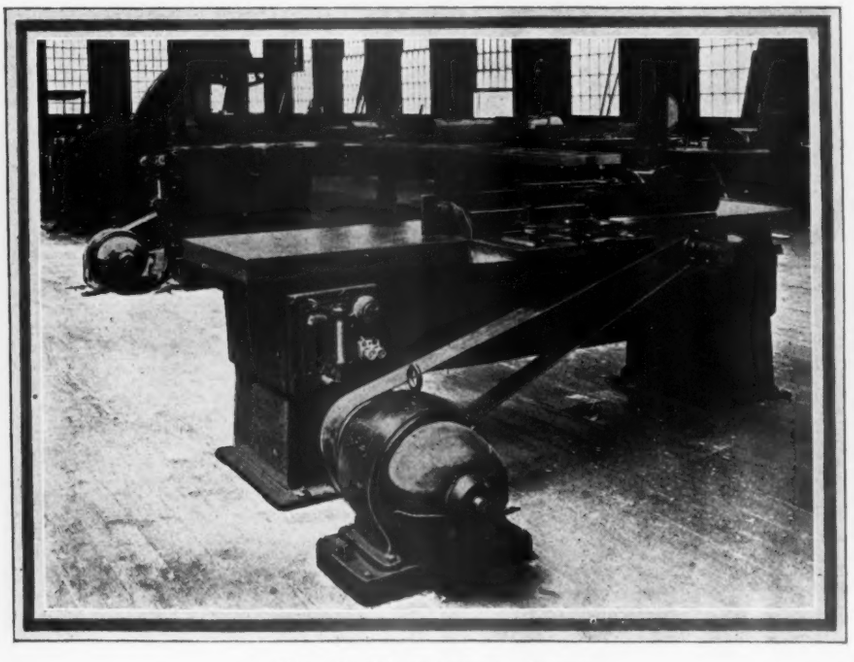


FIG. 3—MOTOR-DRIVEN JOINTER

Pattern Shop Installation.

Machine. Type.	Size, inches.	Motor, horse-power.	Speed, revolutions per minute.	
Cut-off saw	14	5	1,600	
Cut-off saw	14	5	1,600	
Rip saw	14	5	1,600	
Surfacer	..	5	1,600	
Surfacer	24x9	5	1,600	
Jointer	20	5	1,600	
Jointer	20	5	1,600	
Jointer	24	5	1,600	
Lathe	30	5½	450-1,350	
Speed lathe	12	¾	500-1,500	
Speed lathe	20	2	500-1,500	
Bank saws	36	3½	1,050	
Bank saws	36	3½	1,050	
Bank saws	36	3½	1,050	
Swing saw	..	3½	1,050	
Pattern scroll saw	..	¾	700	Direct-connected
Pony planer	24	5	1,600	
Surfacer	..	5	1,600	
Saw filer	..	5	1,600	
Knife grinder	6x40	3½	1,050	Group drive

BRITISH FOUNDRYMEN'S CONVENTION.

Some important modifications have been made in the program of the convention of British Foundrymen to be held at Birmingham early in August. The series of papers previously announced is somewhat modified. The paper on "The Cupola," by H. Pemberton, has been withdrawn, but in place of this a paper dealing with "Recent Investigations on the Structure of Cast Iron" and jointly prepared by F. J. Cook and G. Hailstone, will be given. The proceedings will commence on Tuesday as previously arranged and the sittings will

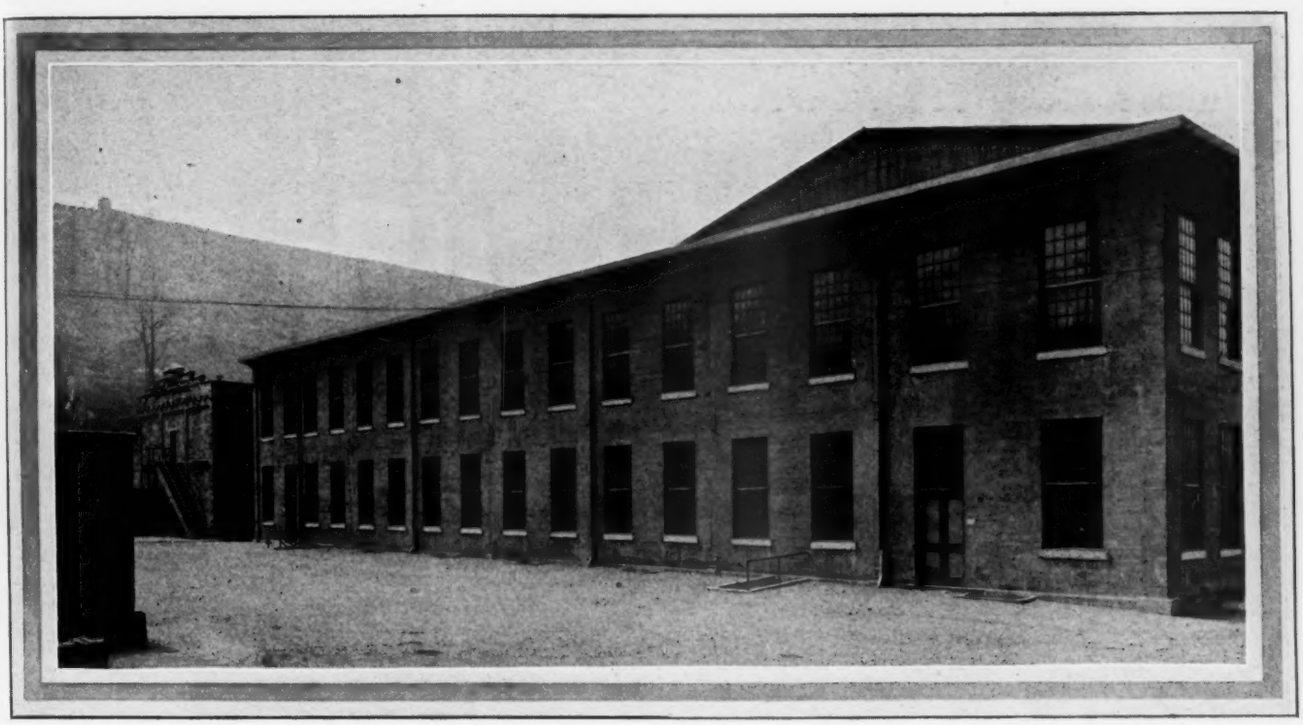


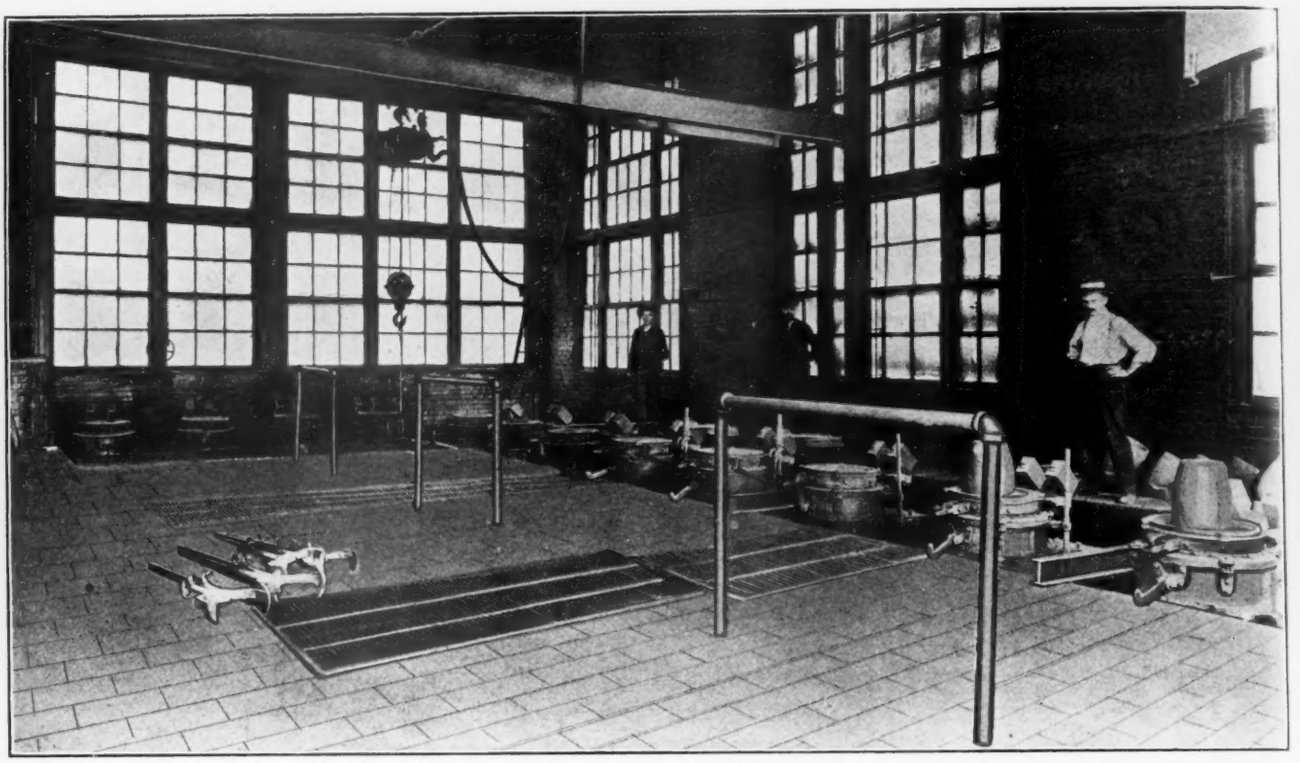
FIG. 4—FIREPROOF, CONCRETE PATTERN SHOP BUILT BY THE MESTA MACHINE CO.

take place at the old buildings of the Birmingham University, where the lord mayor, Ald. J. H. Kenrick, a well known iron founder, will formally receive and welcome the visitors prior to the more serious business of the meeting. The customary annual business will also be transacted. The meeting will be presided over by F. J. Cook, who is located in Birmingham. In addition to the visit to the new university building on Tuesday afternoon, when Sir Oliver Lodge will receive the foundrymen, further visits have now been arranged on Wednesday to the works of Bellis & Morcom, of Birmingham. Following the visit to Bellis & Morcom's there will be a social evening and smoking concert at the Imperial hotel, Birmingham, which will be the headquarters of the association during the convention. On Thursday a visit will be made to the large engineering works of the Thompson-Houston Co. at Rugby, and this will be followed by drives through the county of Warwickshire to Warwick or Leamington, giving an opportunity to see this picturesque district at the most favorable time of the year. A visit to Stratford-on-Avon, which has often proved an irresistible attraction to Americans, may also be included in the program. An invitation was extended to J. P. Frey, editor of *The International Moulders Journal,* who is on a visit to Great Britain, to give a paper at the convention, but the invitation has had to be declined owing to the fact that Mr. Frey will not reach Birmingham in time for the convention. Much regret has been expressed by the British foundrymen over his inability to accept this invitation.

The entire output of the Alaska Graphite Co.'s mines located in the Port Clarence district, Alaska, has been disposed of to a San Francisco concern which will equip a mill and refinery to prepare this material for the market. This year these mines will be operated at their capacity and a large tonnage of graphite will be shipped during the season. The headquarters of the Alaska Graphite Co. have been removed to 1203 Chronicle building, San Francisco, Cal.

The Waterbury Crucible Co., Waterbury, Conn., is sending to the trade a 4-page folder, which contains a list of the sizes of the crucibles manufactured by this concern, together with their liquid capacity.

FIG. 5—PONY PLANER DRIVEN BY A WESTINGHOUSE MOTOR



INSTALLATION OF TWELVE FISHER FURNACES

BATTERY OF TWELVE FISHER FURNACES.

The accompanying illustration shows a battery of 12 fuel oil, crucible furnaces in the plant of the Clayton & Lambert Co., Detroit, which were built and installed by Alfred Fisher, Chicago. The furnaces are used for melting yellow brass, bronze and aluminum, and have a capacity of 190 pounds per heat, each. Eight heats are taken daily, which give a total output from the entire battery of 18,240 pounds of metal. The oil consumption is 3¼ gallons per heat. The furnaces are operated with 15 ounces air pressure, and 25 pounds oil pressure, the blast being furnished from a No. 1 Garden City blower. The furnaces are of the standard Fisher type and are set in a pit, 8 feet deep and 10 feet wide. Brick piers are built in the pit 6 feet apart, with channel iron supports, on which the furnaces rest. The furnaces are spaced 28 inches apart. The air and oil pipes connect with the furnaces in the rear and run the entire length of the battery. The burner is set in at any corner of the furnace and points downwards, so that the flame strikes the pit of the furnace at the opposite side and forms a perfect circuit of flame which envelops the crucible. This method of directing the flame lengthens the life of the crucible. It is claimed that as many as 60 heats have been taken from one crucible in the Fisher furnace, though the average is from 30 to 50 heats. In the Clayton & Lambert foundry the crucibles are lifted out by a swinging crane which reaches all of the 12 furnaces and which can deposit the crucibles any distance within 30 feet from the furnace.

The Fisher furnace has a cast iron bottom and the body is of sheet iron. The cover is also of cast iron, with a 3 x ½-inch band encircling it, securely bolted. The cover is balanced with counterweights, and is easily opened by means of a lever. The furnace body is lined with 6-inch fire brick and is kept in repair with carborundum sand. The first five furnaces of this battery were installed August 16, 1907, and no repairs have yet been made. The second installation, consisting of three furnaces, was made in December, 1908, and the third, consisting of four furnaces, was made in March.

A HANDY SHRINKAGE RULE.

The shrinkage rule shown in the accompanying illustration, made by the Keuffel & Esser Co., Hoboken, N. J., intended for use in foundries, pattern shops, etc., has the same graduation on each of the four edges, which are numbered from left to right, and the rule is therefore always in the proper position for immediate use. Separate rules are made for iron, brass, steel, etc.

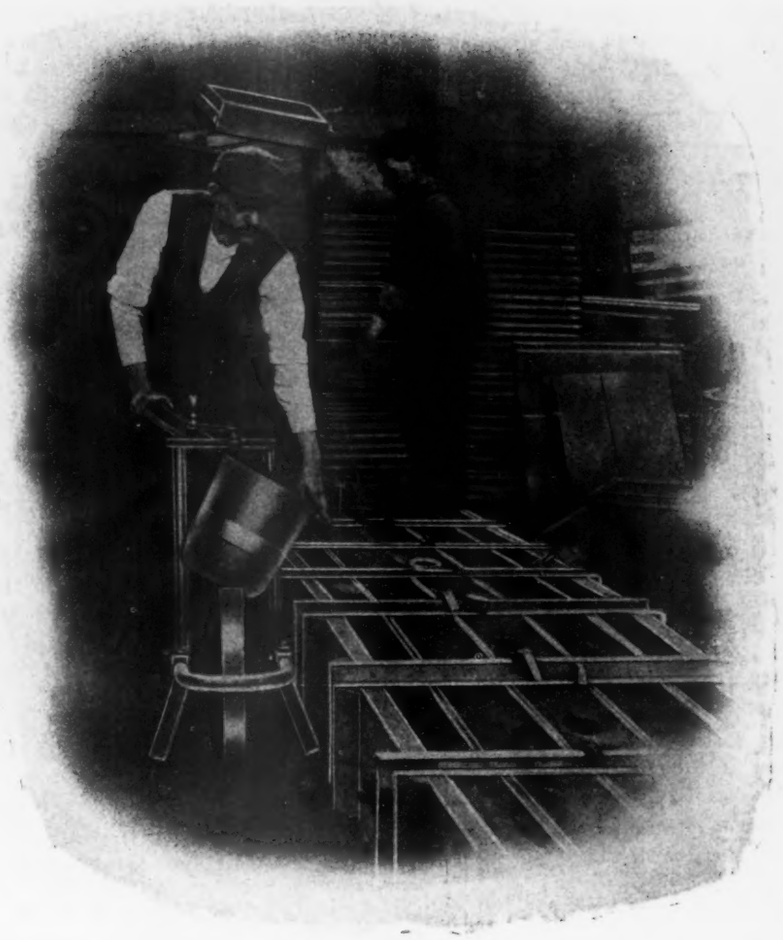
A HANDY SHRINKAGE RULE

THE B. F. STURTEVANT CO. INCREASES ITS CAPITAL.

Owing to the rapid increase of its fan and blower business, the B. F. Sturtevant Co., Hyde Park, Mass., has found it necessary to increase its capital. The new corporation is organized under Massachusetts laws with $1,250,000, 6 per cent, cumulative preferred stock and $1,250,000 common. The stock has all been taken by a few of the large owners. John Carr has been elected president, Eugene N. Foss treasurer and E. D. Freeman general manager. The increased capitalization largely represents capital expenditures during the year entailed in the erection of the new plant in Hyde Park, which cost over $1,500,000. This concern has been doing a business of about $3,000,000 annually, and the plant will be still further enlarged next spring.

THE L. AND I. LADLE CARRIER.

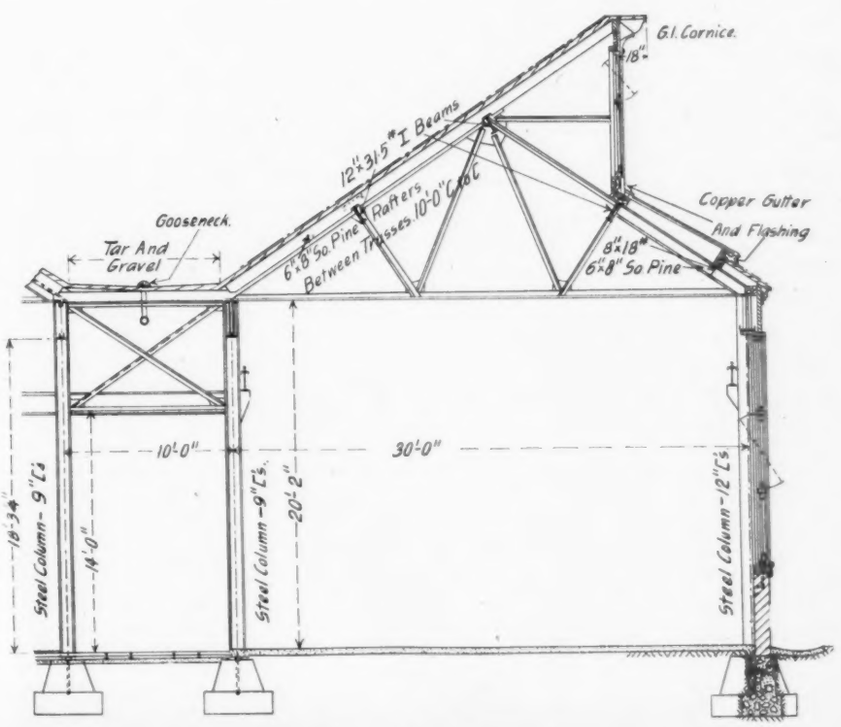
The ladle barrow shown in the accompanying illustration, manufactured by the Herman Pneumatic Machine Co., Pittsburg, eliminates much of the arduous labor of not only the pouring of the molds, but the transfer of the metal to the molding floors as well. The ladle has a capacity of 250 pounds of molten metal which can be easily wheeled from the furnaces or cupola to the molding floor by one man, and the molds can be poured without further assistance. Ordinarily a ladle of this size requires two men not only to carry the metal to the floor, but also to pour the molds. Hot, clean metal is insured at all times. The barrow is well constructed, thereby entirely eliminating danger from accidents, both in conveying the metal and pouring the same into the molds.



LADLE CARRIER

A FOUNDRY SAW TOOTH ROOF.

The arrangement of the saw tooth roof, illustrated herewith, combines the advantages of the vertical sash with its generous distribution of light over a large floor area without direct admission of the sun's rays, and those of the inclined sash which more nearly faces the zenith, but because of its northerly exposure and the overhanging cornice practically also excludes direct light from the sun. The effect on the whole is substantially the same as that of a single inclined sash forming the entire front of the saw tooth, but without some of the features of construction that would thereby be required with such an excessive height of front.



NEW TYPE OF SAW TOOTH ROOF

This type of construction was adopted by F. W. Dean, mill architect and engineer, Boston, Mass., in the design of the foundry erected for Hitchings & Co., Elizabeth, N. J.

Each individual saw tooth is supported by a series of angle steel trusses spaced 10 feet on centers. On top of each truss is a 6 x 6-inch southern pine rafter, while between are 6 x 8-inch rafters of the same material. These latter are supported at the two intermediate panel joints between the cornice and the drain valley by two transverse steel I-beams, 12-inch, 31.5 pounds, which also act as distance rods for the trusses to which they are securely riveted. The roof consists of 3-inch matched plank with slate covering. Extending up for a short distance from the valley it is covered with copper flashing, the valley itself being covered with tar gravel. All water drains to a series of 4-inch copper goosenecks with 10-inch pans and strainers which connect with 4-inch wrought iron drain pipes.

The skylight comprises a vertical and an inclined sash. The former is in two parts, the upper being pivoted to act as a transom for purposes of ventilation. A galvanized iron cornice ex-

tends out 18 inches, sufficient to prevent rain or snow beating in to any extent. The vertical sash is supported on a 12-inch, 31.5-pound I-beam which also acts as a tie and spacer. The inclined sash, which is rigid, is supported by timbers resting on this and a secondary transverse I-beam. The thrust is taken up by 8-inch, 18-pound I-beams, which form a part of each truss. Copper flashing is provided between the vertical and inclined sashes and on the roof just below the latter. Each truss is supported at its ends by steel columns of channel section, spaced 10 feet on centers and resting on brick piers.

PERSONAL.

Dr. Richard Moldenke, Watchung, N. J., will leave about the middle of August to attend the Copenhagen Congress of the International Society for Testing Materials. From there he will go to Germany and France on professional business, and expects to return to the United States about the middle of October.

Irving McDowell has withdrawn from the firm of David Evans & Co., pig iron merchants, Chicago, and has been succeeded by R. A. Ellis.

Charles K. Thomas, formerly sales manager of the D. T. Williams Valve Co., Cincinnati, has been elected vice president of this concern to succeed Francis X. Pund.

Chas. S. Witherell, formerly superintendent of the copper department of the American Smelting & Refining Co., Perth Amboy, N. J., has been appointed superintendent of the copper department of the Balbach Smelting & Refining Co., Newark, N. J.

E. B. Gilmour has been appointed superintendent of the foundry of the plant of the Canada Foundry Co., Ltd., Toronto.

August Kittleberger, who for the past 15 years has been associated with the Clayton Air Compressor Works, has been engaged by the American Air Compressor Works, New York city, as superintendent of its plant in Brooklyn. Mr. Kittleberger has had a wide experience in the manufacture of air compressors, vacuum pumps and kindred lines of machinery.

Eliot A. Kebler, sales manager of Matthew Addy & Co., Cincinnati, has accepted the position of resident agent at Pittsburg of M. A. Hanna & Co., producers of pig iron, Cleveland.

Edgar G. Seeman has severed his connection with the S. Obermayer Co., Cincinnati.

A. C. Millar, for the past nine years superintendent of the foundry operated by John Lang & Sons, Johnstone, Scotland, has resigned to become manager of the foundry operated by Davidson & Co., Ltd., Belfast, Ireland. Mr. Millar received a number of handsome presents from the employes of John Lang & Sons.

H. G. Nicholls, who for several years has been assistant general manager of the Canadian General Electric Co., and the Canada Foundry Co., has resigned and has organized The Factory Products, Ltd., with offices in the Federation Life building, Toronto. This concern will act as Canadian selling agents for manufacturers of factory equipment.

H. M. Taggart recently completed his 21st year of service with the J. W. Paxson Co., Philadelphia. He entered the employ of this concern in 1888 in the capacity of office boy, and after serving in the various departments in the home office, was placed in charge of sales in New York state.

TRADE NOTES.

The Keuffel & Esser Co., Hoboken, N. J., has issued a 16-page booklet describing its plant, growth of its business in the last 30 years, and numerous illustrations are contained therein of the various departments for the manufacture of measuring instruments.

The Hoosier Supply Co., Indianapolis, organized several months ago, has opened a warehouse at 142 East Georgia street, where a complete line of foundry facings and other foundry supplies, as well as patternmakers' and platers' supplies are carried in stock. J. M. Haines, head of this concern, has had wide experience in practical foundry work and was formerly connected with the American Foundry Co., Indianapolis, in the capacity of assistant foreman.

The Ed. E. Squier Co., Bank of Commerce building, St. Louis, has issued a four-page circular listing its various grades of molding sands.

The Cutler-Hammer Mfg. Co., Milwaukee, has purchased the plant and patents of the J. L. Schureman Co., Chicago, manufacturer of controlling apparatus. The services of S. M. McFedries, general manager of the Schureman Co. have been retained by the Cutler-Hammer Co.

The Osborn Mfg. Co., Cleveland, is now manufacturing linseed, liquid core compounds made on a pure linseed oil base for the foundry trade. These compounds are made in three grades, including Osborn No. 1, for cores requiring great strength; Osborn No. 1 Special, for cores used in malleable iron, and Osborn No. 2, for cores used in gray iron foundries. This core compound is shipped in 50 gallon barrels.

"Electric Motor Control" is the title of a handsome booklet published by the Electric Controller & Mfg. Co., Cleveland, which contains a series of five articles on this subject written by A. C. Eastwood, president of this concern. A folder describing lifting magnets, containing numerous illustrations of their application in railroad yards, has also been issued by this company.

Volume I of the *Journal of the Institute of Metals* contains a stenographic report of the first meeting of this organization, held in November, 1908, as well as the annual meeting held the following January. The proceedings cover no less than 304 pages, and the general arrangement of the work reflects great credit upon G. Shaw Scott, secretary of the association, by whom it was edited.

The crucible department of the Joseph Dixon Crucible Co., Jersey City, N. J., is sending to the trade a handsome hanger printed in three colors. Surrounding the scene in a foundry where crucibles are being used, are shown crucible products and accessories such as brazing boxes, bowls and phosphorizers, stirrers, dipping cups, etc. At the top of the hanger is shown the large plant of the Joseph Dixon Crucible Co., and at the bottom are given some concise rules for the proper handling of crucibles. The hangers measure 18 x 26 inches.

J. K. Dimmick & Co., Philadelphia, producers of pig iron and shippers of coal, have opened an office at 53 Pickering building, Cincinnati. E. S. Kendrick has been appointed sales manager.

TRADE PUBLICATIONS.

VISES.—The G. M. Yost Mfg. Co., Meadville, Pa., has issued a 24-page catalog describing its full line of woodworkers' and machinists' vises, as well as wrenches, emergency, clamps, etc.

ENGINES AND BOILERS.—A neat little booklet styled "Engineers' Hand Book" has been published by the Erie Engine Works, Erie, Pa., which, in addition to descriptions and illustrations of the engines and boilers made by this concern, contains many valuable rules and other information conveniently arranged and briefly stated, which should prove of value to every engineer.

CORE OVENS.—The J. D. Smith Foundry Supply Co., Cleveland, has issued a handsomely illustrated, 20-page catalog, which contains many views of core oven installations in foundries throughout the United States. These ovens are of various types, including those on which the cores are placed on cars, rolling drawers, shelves and ovens for drying molds, etc. A list of installations is also appended which shows that more than 100 of these ovens are now in use.

MELTING FURNACES.—A 12-page catalog containing illustrations of installations of the heating and melting furnaces made by the Rockwell Furnace Co., New York, has been received. It includes views of annealing, heating, brazing, hardening, core baking, enameling, forging, galvanizing and ladle heating furnaces, as well as various types of furnaces for melting the softer metals. This concern builds furnaces for practically every purpose using oil, coal or gas as fuel.

HEATING AND VENTILATION.—The American Blower Co., Detroit, has issued three handsome booklets, each devoted to descriptions and various methods of applying the blowers made by this concern. One booklet, entitled "Ventilating and Cooling", illustrates the use of fans for ventilating and cooling factories, stores, public buildings, etc; another booklet briefly described the merits of the "Sirocco" fan; the third booklet is entitled a "Handbook of Information on Blowers and Exhausters for Glass Factories" and contains many valuable tables.

GENERAL INDUSTRIAL NOTES

The D. J. Murray Mfg. Co., Wausau, Wis., is erecting a new foundry 80 x 140 feet. Plans have also been completed for the erection of a machine shop, 56 x 300 feet.

Thomas M. Brennen, formerly associated with the Keystone Steel Casting Co., Chester, Pa., has established a foundry at that place which will be known as the Eagle Crucible Steel & Brass Foundry. This concern will engage in the manufacture of steel, brass and gray iron castings.

The Blaine Foundry & Machine Co., Blaine, Wash., recently organized, has erected a plant 45 x 130 feet, in which are located a foundry, pattern and machine shops. The casting department occupies a space 40 x 45 feet.

The LaCrosse Plow Co., LaCrosse, Wis., has decided not to erect a new foundry this summer, and all new construction has been abandoned for this year.

The O. H. Jones Co., Hartford, Conn., manufacturer of plumbers' brass goods, has recently added a foundry for the production of brass and aluminum castings. This new department occupies about 3,300 square feet.

The Garwood Bronze & Iron Works, Garwood, N. J., recently organized to engage in the manufacture of gray iron, bronze, brass and aluminum castings, succeeds the Enterprise Foundry Co. The officers of this concern are W. S. Tuttle, president, and W. T. Dette, secretary and treasurer.

The Herbst & Angency Co.,, Ltd, Macungie, Pa., has been reorganized under the firm name of the Emaus Foundry & Machine Co., and will shortly remove its plant to Emaus, Pa. The officers of this company are J. H. Angency, president; W. J. Muth, secretary; Milton Frey, treasurer.

The firm name of the Elmira Heater & Foundry Co., Elmira, N. Y., will be changed to that of the Elmira Foundry Co.

The J. W. Pohlman Foundry Co., Buffalo, has been incorporated with $10,000 capital to take over the business heretofore conducted by J. W. Pohlman. This concern operates a foundry for the manufacture of stoves and a general line of gray iron castings.

The South Side Steel & Malleable Castings Co., Milwaukee, recently added a 10-ton cupola and considerable other foundry equipment.

The Franklin Foundry Co., Columbus, O., has been incorporated with $10,000 capital to engage in the manufacture of gray iron castings. The incorporators are Gilbert H. Hamilton, John M. Charles, John J. Keen and A. Rees.

The Burrill Foundry Co., Brantford, Ont., has reorganized under the name of the Brantford Foundry & Development Co., with $4,000 capital. A machine shop will shortly be added.

The equipment of the plant operated by the Means Foundry & Machine Co., Steubenville, O., will be removed to Toronto, O., where the plant of the Toronto Machine Co. has been acquired. The firm name of this concern has been changed to the Means Engineering & Foundry Co., and it succeeds the Means Foundry & Machine Co., Steubenville, O., the Toronto Machine Co., Toronto, O., and the Davis-Price Foundry & Machine Co., New Cumberland, W. Va.

Cyrus Currier & Son, Newark, N. J., have been incorporated under the firm name of Cyrus Currier & Son, Inc. Francis Currier is president and general manager and Cyrus Currier Jr. secretary and treasurer.

The firm name of the Indianapolis Aluminum Brass Co., Indianapolis, has been changed to the Indianapolis Brass Co.

The Early Sun Stove & Range Co., recently organized at Newark, O., has taken over a foundry at Somerset, near Newark, and will soon commence the manufacture of stoves and ranges. The officers of this concern are as follows: President, L. S. Dean; vice president and general manager, C. E. Lady; treasurer, George Wise; secretary, E. J. Mathias.

New Construction.

The Cribben & Sexton Co., Chicago, manufacturers of stoves, have secured a site of eight acres on the Chicago, Milwaukee & St. Paul road, on Ohio street and Albany avenue, on which a new stove foundry will be erected at a cost of about $30,000.

Confer, Smith & Co., Reading, Pa., will erect an addition to their foundry, 65 x 70 feet.

The Lobdell Car Wheel Co., Wilmington, Del., will erect an addition to its plant, 62 x 120 feet.

The Bay State Brass Co., Haydenville, Mass., is building an addition to its foundry, 50 x 41 feet.

The Pennsylvania Foundry Co., York, Pa., will erect a foundry and pattern shop.

The Iowa Stove & Range Co., Waterloo, Ia., will erect a foundry 80 x 136 feet.

The American Roll & Foundry Co., Canton, O., will erect an addition to its foundry, 60 x 40 feet, and the machine shop will be extended 60 x 60 feet.

The Shull Steel Casting Co., Canton, O., has awarded contracts for an addition to its plant, 95 x 100 feet.

The Sharples Separator Co., West Chester, Pa., is building an addition to its foundry, 210 feet long and 40 feet wide.

The Arkansas Foundry Co., Little Rock, Ark., recently incorporated with a capital of $25,000, is erecting a foundry, 100 x 140 feet.

The Enterprise Brass Foundry, Tacoma, Wash., will erect a foundry, 30 x 40 feet and the Pacific Pattern Works of that place will erect a shop 60 x 132 feet.

The Puget Sound Iron & Steel Works, Tacoma, Wash., is preparing to erect a large plant, and the foundry department will be installed in a building 90 x 126 feet. It will be equipped with a traveling crane of 50 tons capacity. The pattern shop will be two stories high, 50 x 150 feet and the pattern storage building will be 50 x 80 feet.

B. F. Avery & Sons, Louisville, Ky., are having plans prepared for the erection of a new agricultural implement plant which will consist of 11 buildings and will include a large foundry.

The Indiana Brass & Bronze Co., Marion, Ind., has under construction new buildings that will practically double the size of its foundry. The finishing department will be increased by the erection of a machine shop, 60 x 80 feet.

At a meeting of the stockholders of the Dundee Brass Mfg. Co., Dundee, N. Y., it was decided to rebuild the foundry which was recently damaged by fire.

The Allyne Brass Founary Co., Cleveland, will erect an addition to its foundry at Carnegie avenue and East Sixty-first street, 87 x 256 feet.

The Falk Co., Milwaukee, Wis., is erecting an addition to its foundry, 220 x 300 feet and 68 feet high. A new pattern shop and pattern storage, five stories high, 120 x 125 feet is also being built.

The Weatherly Foundry & Machine Co., Allentown, Pa., will increase the size of its foundry by the erection of an addition 30 x 70 feet to make provisions for the steel furnace which will shortly be added.

The Phillips & Buttorff Co., Nashville, Tenn., contemplates the erection of an additional stove foundry.

A new brass foundry for the production of gold, silver and fine bronze castings has been placed in operation by F. Chapon, 346 Washington street, Newark, N. J.

The Doehler Die Casting Co., formerly located at 369 Park avenue, Brooklyn, is now located in its new foundry at 187 West 9th street, that city.

The capital stock of the Portland Foundry & Machine Co., Portland, Ind., has been increased from $25,000 to $50,000 and a new plant will shortly be erected consisting of a gray iron foundry, machine shop, drop forging plant and a power plant. The buildings will be of brick and concrete construction. This concern would like to receive catalogs and printed matter from manufacturers of foundry and machine shop equipment.

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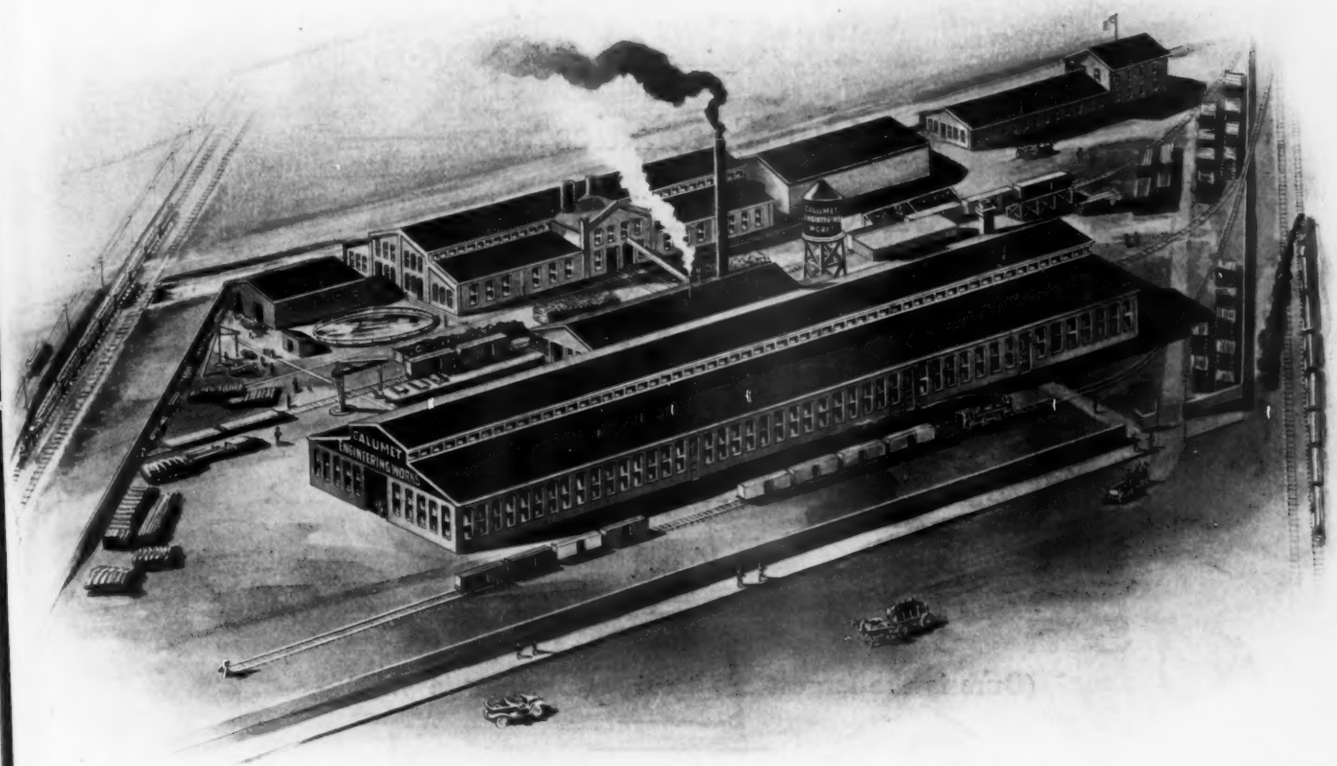

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